SCIENTIFIC AMERICAN

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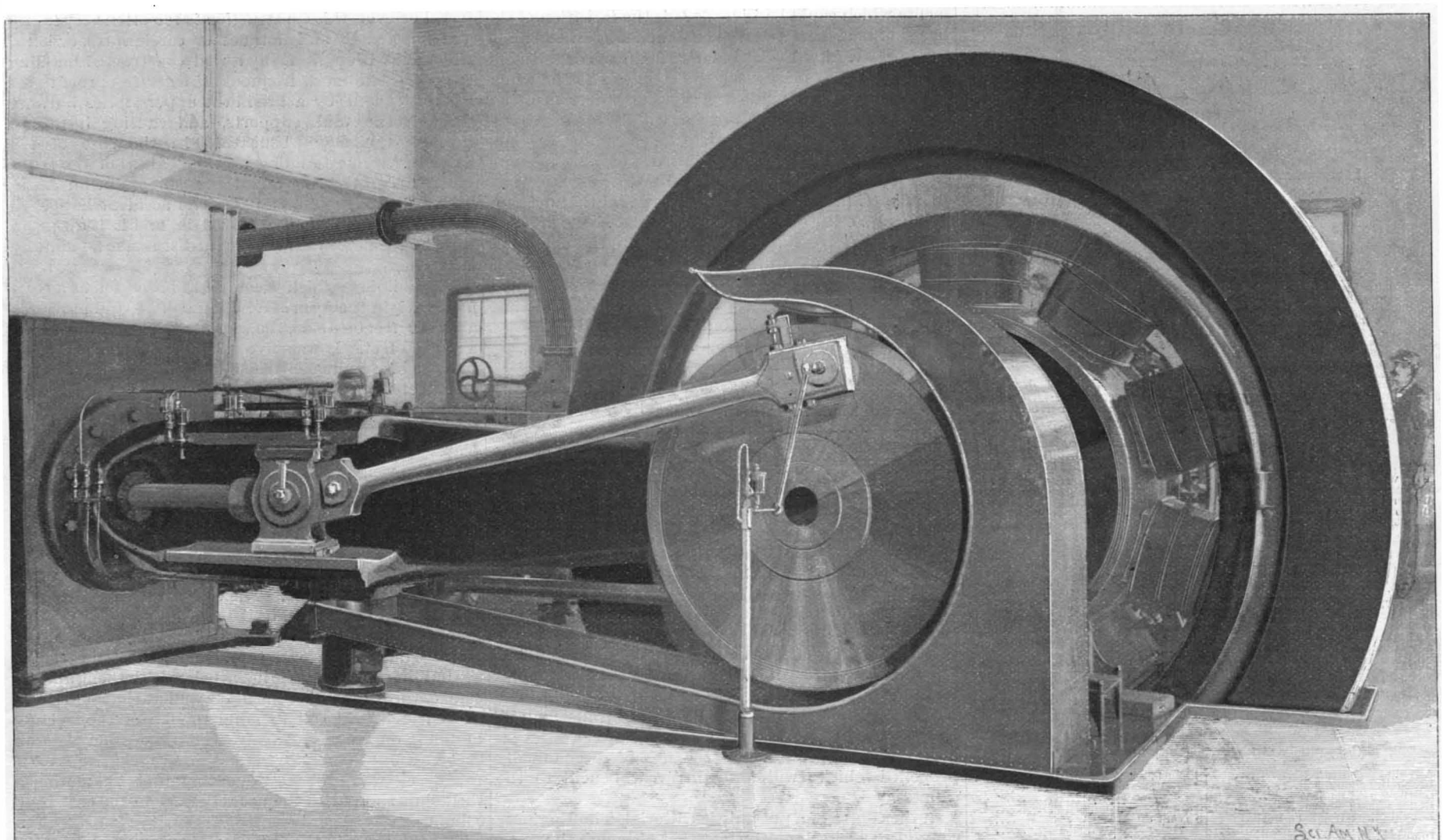
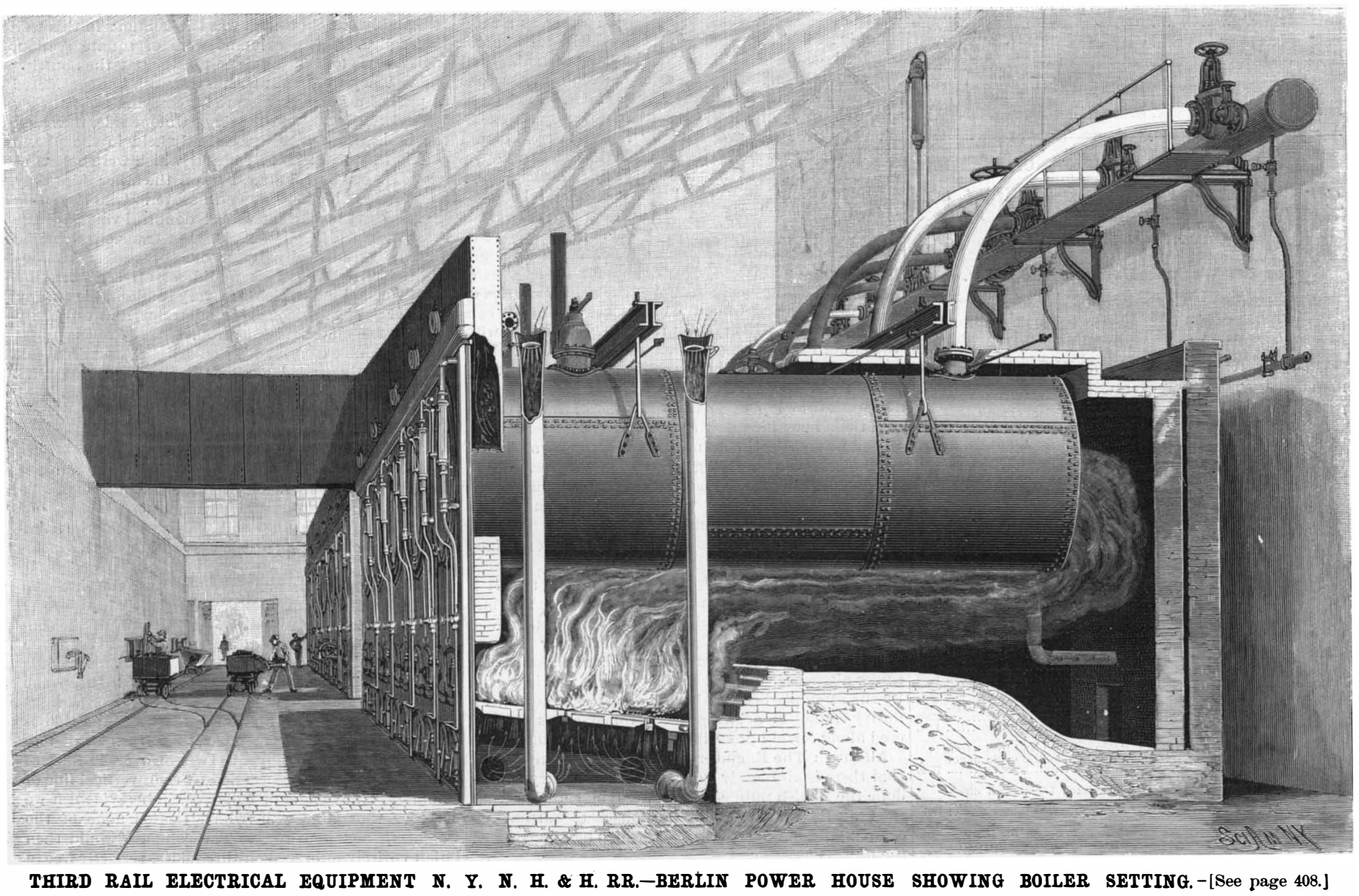
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXVI.—No. 26. ESTABLISHED 1845. | NEW YORK, JUNE 26, 1897. | $3.00 A YEAR. WEEKLY.



TWELVE HUNDRED HORSE POWER CROSS COMPOUND ENGINE—BERLIN POWER HOUSE.



THIRD RAIL ELECTRICAL EQUIPMENT N. Y. N. H. & H. RR.—BERLIN POWER HOUSE SHOWING BOILER SETTING.—[See page 408.]

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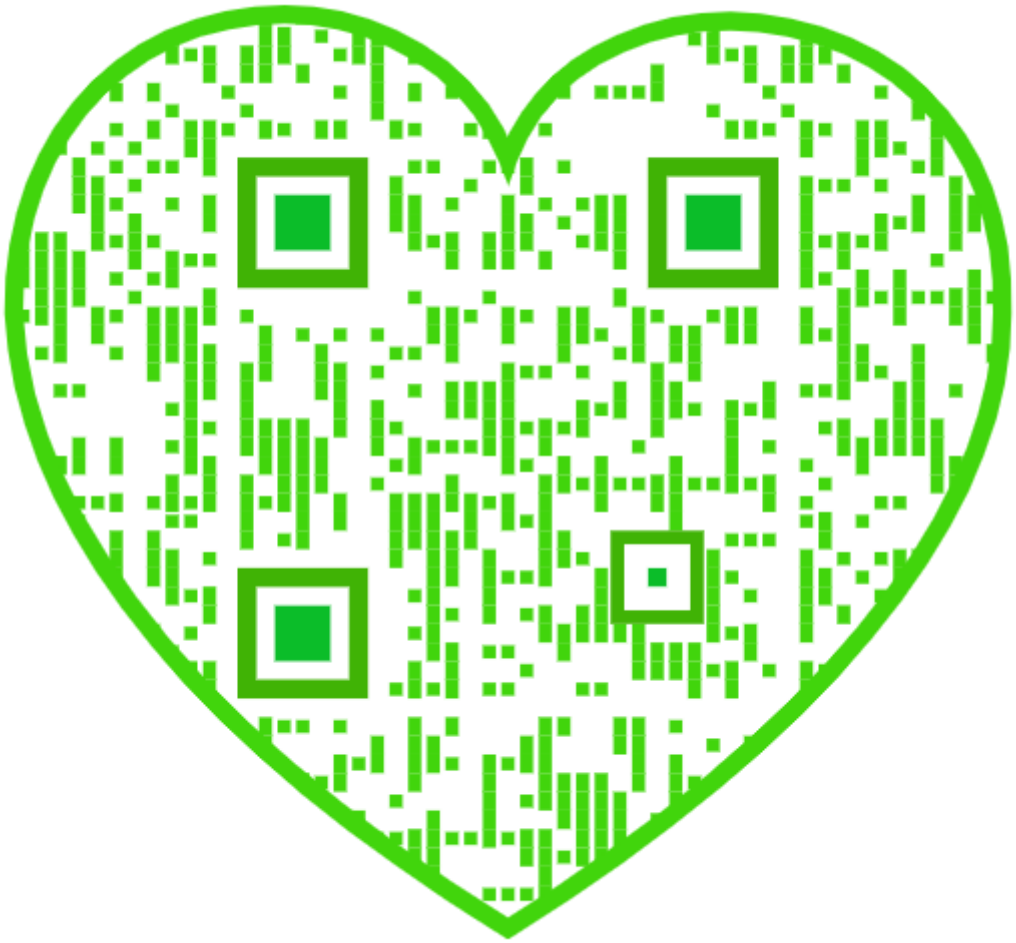

Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

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(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.....$3.00
One copy, six months, for the U. S., Canada or Mexico..... 1.50
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

The Scientific American Supplement
(Established 1876)

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico, $6.00 a year, or £1 4s. 8d., to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

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NEW YORK, SATURDAY, JUNE 26, 1897.

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AMERICAN INSTITUTE FAIR.

The managers of the American Institute Fair, which is to be held from September 20 to November 4, at Madison Square Garden, intend to put forth special efforts to make this one of the most interesting fairs in the history of the institution. As our readers are doubtless aware, the American Institute is one of the oldest organizations of its kind in America. It is now verging on its seventieth year. During its long life it has been one of the most powerful factors in the promotion of invention and industry in the country. Many of the famous inventions of the past forty years received their first recognition at its hands, and to secure the institute medal was one of the most coveted indorsements which could be given. It is the intention of the board of managers and the general superintendent of the fair, Mr. Alfred Chasseaud, to make the department of engines and machinery the strongest in the whole exhibit. It is to include a very wide variety of prime movers, and particular attention will be given to stationary engines operated by steam, gas, water, or wind. There will also be a large exhibit of pumping machinery, steam fire engines, iron and wood working machinery, textile and paper machinery and that used for the manufacture of leather and rubber. We are glad to note that the fair is to be held in the capacious Madison Square Garden, and the scale on which it is to be carried out indicates that the renewed life and vigor which marked the operations of the institute last year is likely to be permanent.

THE ENGINEER MOTOR CAR COMPETITION.

The celebrated motor car competition organized by The Engineer, of London, has resulted, according to our contemporary, in a miserable failure, only five vehicles putting in an appearance at the Crystal Palace, London; and even this pitiful remnant of the original seventy-two entries was, in the opinion of the judges, so lacking in the qualities that go to make up a really useful and reliable motor that they made no award, and the six thousand dollars which was to have been awarded in prizes was handed back to the promoters of the competition.

The first offer of a prize of one thousand guineas was made about two years ago, and the conditions, as formulated a few months later, announced that prizes would be awarded "for the encouragement of manufacturers and designers of horseless carriages," The Engineer "believing that an important trade may be created in this class of machinery, and that the removal of the restrictions on the use of mechanically propelled vehicles will result in great benefit to the farmers."

In the course of a pessimistic editorial, The Engineer congratulates itself on the fact that although the essay has failed in its original purpose, it has "cleared the air" and shown the true facts concerning the so-called motor car industry in England. "There is at present no such industry. There is no such thing as a thoroughly satisfactory self-propelled vehicle. If a motor car of the kind existed, it would have been submitted for competition." Now these are sweeping assertions and not altogether warranted by the facts. In the first place the competition was narrowed down by the exclusion of all vehicles propelled by light oil or petroleum spirit, against which The Engineer has shown a persistent prejudice from the very first, although on its own admission "very little success had been obtained with vehicles which did not use petroleum spirit." This prejudice was so marked that it is not surprising that the subsequent offer of a special prize of five hundred and twenty-five dollars for vehicles using light oil failed to bring forward the manufacturers of what are admitted to be the only successful motor cars on the market. Everybody that keeps in touch with the motor car industry is well aware of the defects of oil-driven motors, and none more so than the makers themselves. But for The Engineer at this early stage of the work to sweep aside three-fourths of the inventors and their machines, and suppose that it can be determined by an ex cathedra mandate what shall and what shall not be the surviving type of motor car, may be agreeable to the traditions of that journal, but, as the recent fiasco has proved, will have a very small effect upon the motor car industry at large.

In defense of the course it took it is explained that it had no particular desire to develop pleasure carriages, as its "purpose was utilitarian," and it is pointed out that the unpleasant odor which comes from most oil motors would prohibit their commercial use in a crowded city. But in taking it for granted that this difficulty is incurable our contemporary assumes altogether too much, and the most that is proved by the attempted competition is that the motor car industry cannot be arbitrarily controlled so as to proceed along certain prescribed lines of development

Although The Engineer claims too much in stating that there is absolutely no motor car industry, it has done the British public good service in showing that the industry has no such proportions as to warrant the company-promoting speculations which have entrapped the unwary investor.

In the next issue of the SCIENTIFIC AMERICAN SUPPLEMENT we shall give illustrations and particulars of some of the motor cars which were present on the morning of the contest, including the two which received favorable mention from the judges.

FALL OF A NEW BUILDING IN NEW YORK CITY.

The collapse of a building on Fifty-second Street and Twelfth Avenue has again drawn attention to the risks which are liable to be incurred by the erection of massive water tanks on the top floors of a building. When the tanks themselves and the supports which carry them are properly designed, there is, of course, no more risk than is involved in carrying any other form of static load at the top of a building. As a matter of fact, however, this construction is too often very faulty and marked by an ignorance or carelessness, or both, which has brought many a well constructed building to grief. The most frequent disaster from roof tanks is that caused by a fire in the upper stories burning through the tank supports, and causing it to fall through the floors beneath. In the case of the Twelfth Avenue building the heavy load of the tanks was sufficient to bring about the collapse of an extraordinarily faulty building. The accident happened before the occupants had moved in, and it is owing to this circumstance that the death list is not a painfully large one.

The building, which was to have been used as a soap factory, is in the form of a hollow square, and measures about 200 feet on a side, the width from wall to wall being about 60 feet. It was five stories in height, and was built of composite construction, with cast iron columns and steel floor girders. On the lower floors the girders are 15 inch I beams, but on the fourth floor 24 inch I beams, with their flanges reinforced with two ⅝ inch plates were used, the girders being made heavy to carry the weight of fourteen tanks, each of which with its full load weighed nearly eighty tons. The tanks were 13 feet square and 15 feet deep, and were placed in a double row on the outside of the building, one row of seven standing near the outer wall and the next row about ten feet from it and close against an interior row of columns. The collapse took place while the tanks were being tested for leaks. They were approximately full of water when, without any warning, five out of the seven in the outer row fell through the building, carrying the floors below with them, and, of course, throwing down the outer wall at the same time. The accident will call to mind the fall of the Ireland building, on West Broadway, where the same class of construction was employed, and although in that case the wreck was primarily due to faulty foundations, the debris showed all the usual defects in the cast iron columns.

The great gap in the outer wall is very suggestive as to the origin of the disaster, and a closer inspection of the wrecked iron work, and of the plan of construction as shown in the work which is still standing, makes it reasonably certain that it was the columns in this wall that failed. These columns were of square section, with flanges for bolting them together at the abutting ends. They were built within the wall, but considered as part of a framed structure for carrying weight, they were virtually without bracing. On one side, that next the tanks, they were theoretically held in the plumb position by the 24 inch I beams which were bolted to lugs cast on the columns, but on the other sides they had no metal connections whatever. The stiffening afforded by the I beams was of doubtful value, for the heavy load which they carried was transferred to the columns eccentrically by means of the small lugs above referred to. This would set up cross bending strains of a kind which are very undesirable in any member subject to compressive strains, and especially so when the material is cast iron.

In the course of some tests on full size cast iron columns recently carried out at the Yorkshire Engineering College, Leeds, it was found that, when the load was applied to side brackets or lugs such as we are considering, the column failed by a diagonal transverse fracture whose appearance indicated that it was the bending effect of the eccentric load that produced the failure. A load applied from the side cannot be treated as a load applied in the direction of the axis of a column, and a very liberal allowance should be made for this in determining the cross section of the member.

In addition to this predisposing cause, the throwing of the columns out of line is rendered easy in this form of construction by the unsatisfactory nature of the connections, which usually consist of simple flanges, in the present case held together by only four bolts. While it is true that this might be sufficient to keep the columns in line when there was no load or a light load upon them, the flimsiness of the connection is apparent when we remember that, in addition to the various floor weights, a load of over 40 tons of tank and contents was carried by each vertical line of columns. The danger of collapse will be evident if we consider the outer wall (which carried none of the weight) to be taken away. The columns would then be left entirely unbraced on three sides, perfectly free to buckle at the joints in the line of the wall, and only

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kept from buckling outward by a few bolts fastening column to girder.

It is to be hoped that the day is coming when cast iron will be entirely replaced by steel in buildings of a composite character. Its great compressive strength is more than offset by its low shearing and tensile strength and its uncertain behavior renders it altogether unfitted for use where the strains are more or less complicated and where, as in the present case, the lives of many scores of operatives are at stake.

If cast iron is to be used at all in the skeleton of a composite building, it should be used with great care and careful judgment. The abutting ends of posts and columns should be in all cases carefully machined, and the flanges and flange bolts should be larger than are now frequently employed. Loads should be concentrically applied to wall columns, even if it involves the use of twin girders, one on each side of the column. Above all, transverse bracing of some kind should always be employed for the exterior or wall columns, and it should be attached to the columns as close as possible to the abutting joints. Where heavy superimposed loads are to be carried the wall should not be entirely depended upon to furnish lateral stiffness. There is liable to be poor contact between wall and columns, and a small clearance would be sufficient to allow a fatal lateral movement of the column line.

It is sincerely to be hoped that the lessons of this disaster, which might well have been one of the most calamitous on record, will be noted by the building departments of this and other cities, and that, if cast iron columns continue to enter into building construction, they will be subject to a most searching scrutiny by expert professional men.

CHARGES AGAINST A PATENT FIRM.

Owing to the large number of complaints from inventors received at the Patent Office relative to the alleged unprofessional methods used by Wedderburn & Company to obtain clients and their neglect to serve them properly before the department, Commissioner Butterworth has summoned the firm to appear before him and answer numerous charges of unprofessional conduct. A hearing is to be had before the Commissioner in a few days, and if the charges are sustained they will be debarred from practicing before the Patent Office.

ANOTHER TRANSATLANTIC STEAMSHIP SERVICE.

After some years of unsuccessful agitation of the question of a subsidized express steamship line between England and Canada, it now seems that the Canadian fast Atlantic service is to be established on a permanent basis. The contract has been signed by Messrs. Peterson, Tate & Company, of Newcastle, who are the parties interested. Four vessels are to be provided, each of which must be able to maintain an average speed of 500 nautical miles per day, or about 21 knots. The contract calls for ships 520 feet long and of 10,000 tons register, and they are to be equal in every respect to the best steamers in service on the Atlantic to-day. Each vessel is to accommodate 300 first-class, 200 second-class and 800 steerage passengers, and must possess a cargo accommodation of 1,500 to 2,000 tons, 500 tons of which must be cold storage.

Two of the ships are to be ready by May 31, 1899, the other two by May of the following year. The ships will be run fortnightly during the season of 1899 and weekly during the season of 1900. The starting point will be from Liverpool, and during the summer months the ships will run to Quebec and Montreal as long as the navigation permits; during the winter season they will run to Halifax, N. S., or St. John, N. B., according to the option of the contractors. Vessels are to call at an Irish port, if required to do so by the government.

Messrs. Peterson, Tate & Company will receive a subsidy of $773,000, one-third of which will be paid by the British government and two-thirds by the Canadian government, and the contract is to cover a term of ten years.

This addition of four first-class express steamers to those already afloat, together with the giant Oceanic building for the White Star Line, and the truly splendid twin ships of the North German Lloyd Company, which commence active service this year, will give transatlantic passengers the choice of over a dozen boats that are of 20 to 22 knots speed and furnished with the latest luxuries of ocean travel.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

The twentieth convention of the National Electric Light Association met at the International Hotel, Niagara Falls, N. Y., on June 8, 9, and 10. There was a very large attendance, three hundred members being present, and nearly one thousand visitors who were interested in the proceedings were also at Niagara Falls. The meeting was called to order by President Frederic Nicholls at 10:45 A. M., on June 8. Letters of invitation were read from the various companies located in Niagara Falls and the vicinity which invited the members to visit the various plants. Letters of regret from Lord Kelvin and others were read. President Nicholls made an interesting address and the reports of the committees and reading of papers followed. Each day of the convention was filled up with the transaction of business, the reading of papers, and excursions to the interesting places and plants in the vicinity. The following were the principal officers elected: President Samuel Insull, of Chicago; first vice president, A. M. Young, Waterbury, Conn.; second vice president, George R. Stetson, New Bedford, Mass.

THE AEROPLANE FLYING MACHINE.

BY A. M. HERRING.

Owing to the wide interest excited by the many articles on the mysterious but elusive airships with which the daily papers have been filled in the past few months, it may be of interest to the SCIENTIFIC AMERICAN'S readers to learn that though these "news items" were all the creations from the brains of imaginative persons, yet scientific experiment has been carried on by many able inventors in working on what may be called the true flying machine; that is, one which is hundreds of times heavier than the air upon which it rests, by reason of its dynamic impact, and not by the aid of any balloon or gas bag whatsoever. This line of experiment has resulted in such great progress in the last few years (and especially so in the last six months) that the attainment of long, free flight for man, which not long ago seemed an invention for the far distant future, is a thing now near, if not quite at hand.

Of all the experimenters who have attacked this problem previous to the last decade, but very few indeed have seemed to have known and comprehended the nature of the real difficulties which were to be met with in the securing of the flying machine; i. e., the difficulties involved in obtaining automatically a safe equilibrium, and in securing horizontal flight. Perhaps the greatest genius who ever worked on the flying machine problem was M. A. Pénaud, a Frenchman, who in 1871 produced a screw-driven flying model provided with a small rear surface which acted as a regulator. This regulator controlled his model to such an extent that its average flight, as a whole, was horizontal, but its course, however, was composed of a number of undulations. It has been pointed out, and insisted upon by several writers, that in the elasticity of its surfaces it contained the fundamental principle which made this regulation possible—but this is not the case; for actual experiment distinctly proves that a Pénaud model will fly farther and is more stable with perfectly rigid surfaces than with those which are flexible. This regulator does not maintain a horizontal equilibrium except in very mild winds. Yet this model should stand out above all others, because it was the first dynamic aeroplane provided with an automatic regulator that actually made free flights. These were up to 131 feet in length and lasted on some occasions as much as eleven seconds. Pénaud calculated that it sustained 81 pounds per horse power.* (His model weighed a little over half an ounce and had half a square foot of sustaining surface.)

As his model exposed 15 square feet per pound weight, it is evident that a practical machine on this basis could never be built. Besides that of Pénaud many dynamic aeroplane models have been produced in the past by Tatin, Moy, Stringfellow (whose model is now preserved as a historical relic in the National Museum in Washington), Lawrence Hargraves, of Australia, an indefatigable worker, who produced no less than twenty models which would actually fly, the most of them being actuated by rubber springs, but some by steam and a few by compressed air. One of the latter type, which was presented three years ago to the Field Museum, of Chicago, is on exhibition in this country. It is remarkable for the fact that it sustained a horizontal flight for 19 seconds, during which time it covered a distance of over 300 feet and carried in flight a little over 75 pounds per horse power.† Its surfaces, however, are unduly large, 6½ square feet per pound weight. (A practical machine will probably be required to sustain from six to fifteen times this loading.) Mr. Hargraves is the inventor of the cellular kite used by the weather bureau. He is purely a scientific experimenter who has given his valuable work to the world without reserving to himself any patents. Besides the above mentioned the writer, in 1890, produced a rubber spring driven model which attained horizontal flight through the action of an automatic regulating device, working on a new principle, but in outward appearance somewhat similar to that of Pénaud. This model sustained 157 pounds per horse power with 6 square feet per pound weight.‡ Its flights lasted from six to seven seconds, during which time it covered distances from 100 up to 135 feet. This model, which is still in existence, was exhibited in the spring of 1892 to an acquaintance who, some time later, described its flight in a small account in one of the Rochester, N. Y., papers, and in the fall of 1895 it was exhibited also to Dr. Langley, the distinguished secretary of the Smithsonian Institution, who took dimension sketches of it and who was so much pleased with the flights and the action of its regulator that he requested the writer to fly it repeatedly, first with the regulator in action and then without it.

In the year 1891 the writer constructed an improved and larger model (weighing 5 lb. and exposing 15 square feet of surface), fitted with compound steam engines and a condenser. This model furnished the power for its own start—but its best flight was only about 240 feet—although it carried fuel and supplies for several miles. Petroleum was used instead of water in the boiler. The reason that only a short flight was obtained was due to the boiler blowing up before enough trials were had to properly adjust the regulator. The damage from the heat of the burning of the boiler's contents ruined the small engines, which were built of tempered tool steel. Owing to the pressure of other affairs, this model was not rebuilt.

Pre-eminent in the field of aerodynamics stands the secretary of the Smithsonian Institution, Dr. S. P. Langley, who has done more than any one else (except possibly it be the late Otto Lilienthal, of Berlin, Germany) to place the subject on a sound basis; for his "Experiments in Aerodynamics" will hereafter be looked upon as one of the pioneer lights which directed modern scientific effort to the subject of aerial navigation. This work, contrary to the prevalent belief of engineers, showed that in so far as the question of power was concerned, flight was possible. Dr. Langley has since then directed his efforts to the production of a model which should demonstrate that the further difficulties might be overcome. This model flies from one-half to seven-eighths of a mile, uses steam, weighs about 30 lb. complete, and employs a pair of engines furnishing between one and one and one-half horse power. It may be questioned, however, whether Dr. Langley's expressed views as to what he has accomplished, and his predictions of the future prospects and uses of the flying machine, are not too sanguine; for it is doubtful whether with the most economical heat engines that have ever been constructed the flying machine, carrying even one passenger alone, will ever be able to fly for a day—not days at a time or at a speed which exceeds 80 to 90 miles an hour. That it will never carry freight is almost certain. It is even probable that the machine of sufficient size to carry more than two persons is an invention for the relatively distant future. With all deference to the opinions expressed by so eminent a scientist, it might be pointed out that with the low economy in supporting effect obtained with this model (30 lb. per horse power) * it is not possible to add a condenser, and a machine built on anything like a similar scale for carrying a man would not be able to lift its own weight! For, if we double the lineal dimensions, we would have but four times the surface (lifting effect), while we would be hampered by eight times the original weight. It may be argued that, by reducing the angles at which the surfaces are presented to the air, a larger lifting effect per horse power would be obtained. The maintenance of a small angle in flight is, however, one of the most formidable difficulties of the whole flying machine problem. From the simple laws which govern the thrust of helical screw propellers, it might be shown that the expenditure of 1 horse power on a pair of screw propellers 39 inches in diameter (the size given by Langley) would produce a flying or a standing thrust of 16·3 lb., or 54·3 per cent of the weight of his aerodrome. It can further be shown that with a boiler pressure of 150 lb. to the square inch, the pair of engines of the size given (1¼ inch bore, 2 inch stroke) would each produce 40 to 45 foot lb. (net) on the shaft per revolution. This much spent on a 39 inch properly made screw would produce a thrust (flying or standing) of at least $10\frac{29}{100}$ lb., and the pair of engines acting on a pair of propellers would give a thrust $20\frac{58}{100}$ lb., that is, $68\frac{6}{10}$ per cent of the weight of the aerodrome, and possibly more. The lower boiler pressure given, 110 lb., would give a thrust in flight for standing of 16·4 lb. These thrusts are so extraordinarily large in proportion to the weight carried on the aeroplanes that it might well be questioned if the possibilities of aerial navigation, which Prof. Langley claims to have demonstrated, are not more imaginative than real.

It has not been possible in an article of this length to touch upon the value of the work done by the late Otto Lilienthal nor the exceedingly valuable results published of the experiments of Mr. Hiram Maxim, which, although fragmentary, are of the utmost value to the engineer.

* Even if we accept Pénaud's figures and reduce the weights sustained to what it would have been on a model loaded to 1 pound per square foot, we should find that he could have carried but $81 \div \sqrt{15}$, or say 22 pounds per horse power.

† Seventy-five pounds per horse power on 6½ square feet of surface to the pound weight is equivalent to 29·8 pounds per horse power, if the model were loaded to 1 pound per square foot.

‡ One hundred and fifty-seven pounds per horse power on 6 square feet to the pound is equivalent to 60 pounds per horse power with a loading of 1 pound per square foot.

* The dimension sketch given by Prof. Langley in the Aeronautical Annual for 1897 shows about 75 square feet of supporting surface. The whole weight is given about 30 lb., equivalent to 2½ square feet per lb. wt. Assuming the power at 1 horse power, it shows 30 lb. were carried at that weight with a loading of 1 lb. on 2½ square feet. This, reduced to a loading of 1 lb. per square foot, is equivalent to barely 19 lb. per horse power, with which lift neither a condenser nor man flight is possible.

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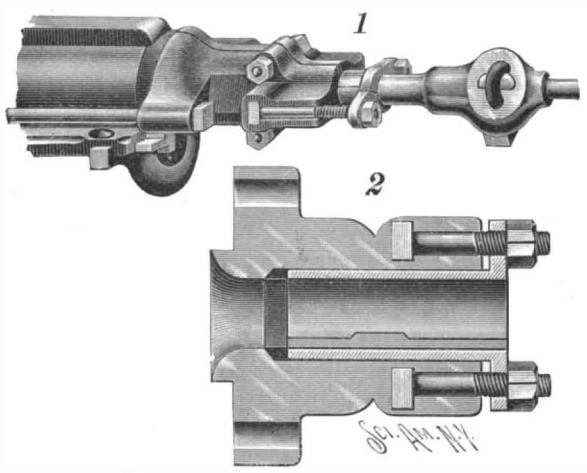
Curious Error in a Trade Mark.

An amusing piece of ignorance is shown in the case of a trade mark recently issued for rye whisky. The proprietors of the trade mark have shown a greater knowledge of art than of history. The design represents, in martial attire, the bust of the unfortunate General Braddock. The hair is arranged artistically with the conventional queue, the bristling stock and the shimmering epaulets are elaborately displayed, but the specification describes the general as depicted in the uniform of an officer of the Continental army. General Braddock would surely be a little startled to learn that he had been deprived of his rank as an officer in the British army and had been adopted willy nilly into the American army. He would, however, be still more puzzled to know how he could be translated into the ranks of an army which did not exist until twenty years after his death. We advise our friends of the "still" to brush up their history and to turn the poor unfortunate back into his regulation red coat.

AN IMPROVED ROCK DRILL.

The illustration represents a head for rock drill cylinders in which the packing is placed at the base of the head, or close to its connection with the cylinder, whereby lateral pressure on the drill rod or piston rod will have no perceptible effect on the packing, thus preventing escape of the motive agent and prolonging the usefulness of the drill head. The improvement has been patented by Warren Wood, and is being introduced by the McKiernan Drill Company, of No. 120 Liberty Street, New York City. Fig. 1 shows the improved head connected with the cylinder, Fig. 2 being a sectional view. The head comprises a casing made in two separable sections secured together by transverse bolts, the casing sections having perforated lugs by which the head may be bolted to the drill cylinder, and within the bore of the casing is a bearing sleeve made of two longitudinally separated sections, one edge of each section having a projection engaging the edge of



THE McKIERNAN ROCK DRILL.

the other section. The joints between the sections of the casing and of the bearing sleeve respectively are out of line, to prevent any escape of the motive agent. The inner end of the sleeve rests on the packing and at the outer end of each sleeve section is a lateral perforated lug to receive tie bolts by which the sleeve may be forced tightly against the packing. When a drill works at an acute angle it is frequently the case that a new stuffing box or gland will have to be often supplied —a difficulty which this invention is designed to overcome.

Coal Production of the United States.

The compilation of the statistics of coal production in the United States in 1896, which has just been completed by Statistician E. W. Parker, of the United States Geological Survey, shows that the product in 1896 was 190,639,959 short tons, valued at $195,557,649, against 193,117,530 short tons, valued at $197,799,043, in 1895, a decrease of 2,477,571 short tons in amount and of $2,241,394 in value. The decrease in product was entirely in that of Pennsylvania anthracite. The output of bituminous coal shows an increase of about one and three-quarters million tons. The anthracite product of Pennsylvania decreased nearly four and one-quarter million tons. It is a notable feature, however, that there was a decrease in the value of the bituminous product of over $1,600,000, notwithstanding the increased output, and that there was a comparative increase in the value of anthracite, although, on account of the smaller production, it did not equal the value in 1895. The average price obtained for anthracite at the mines increased from $1.41 in 1895 to $1.51 in 1896. The average price for bituminous declined from 86 cents to 83 cents.

Among the important bituminous coal producing States, Pennsylvania, of course, stands first, with an output of nearly 50,000,000 tons. Illinois is an easy second with nearly 20,000,000 tons, or more than 75 per cent of the combined product of West Virginia and Ohio, which come third and fourth respectively. The race between Ohio and West Virginia was very close in 1896, there being but one thousand tons difference, and the output of each nearly 13,000,000 tons. These four States yield about 70 per cent of the total bituminous production.

Pennsylvania's bituminous product was a little more than one million tons less than in 1895. Ohio lost 480,000 tons. West Virginia increased her output about 1,500,000 tons and Illinois about 2,000,000 tons. The other important States showing increased production were Alabama, Arkansas, Colorado, Indian Territory, Kentucky, Maryland, and Texas, while Indiana, Iowa, Kansas, Missouri, Montana, New Mexico, Tennessee, Utah, Virginia, Washington, and Wyoming showed decreased production. West Virginia had the most important increase among the Appalachian States, Illinois in the Middle West, and Colorado was the only State in the Rocky Mountain region whose production increased.

The production by States is shown in the following table:

COAL PRODUCT OF UNITED STATES IN 1896 BY STATES.

States.	Total Production, Short Tons.	Total Value.
Alabama	5,745,617	$5,171,055
Arkansas	669,374	743,577
California and Alaska	93,776	220,523
Colorado	3,139,078	3,630,652
Georgia and North Carolina	246.359	179,770
Illinois	19,786,626	15,809,736
Indiana	3,905,779	3,261,737
Indian Territory	1,366,646	1,918,115
Iowa	3,954,028	4,628,022
Kansas	2,764,801	3,175,032
Kentucky	3,183,478	2,496,806
Maryland	4,143,936	3,299,928
Michigan	92,882	150,631
Missouri	2,331.542	2,518,194
Montana	1,484,445	2,176,422
New Mexico	622,626	930,381
North Dakota	78,050	84,908
Ohio	12,875,202	10,253,461
Oregon	101,721	294,564
Pennsylvania—		
Bituminous	49,101,148	35,024,918
Anthracite	53,771,890	81,415.785
Tennessee	2,658,606	2,276.795
Texas	544,015	896,251
Utah	418,627	500,547
Virginia	1,254,723	848,851
Washington	1,195,504	2,396,078
West Virginia	12,876,296	8,336,685
Wyoming and Nebraska	2,233,184	2,918,225
Total	190,639,959	$195,557,649

Effect on Bridges of Motive Power at High Speeds.

This subject, having been brought under the consideration of the Association of Railway Superintendents of Bridges and Buildings, was referred to a committee consisting of Messrs. George W. Andrews, J. E. Grenier, and Walter G. Berg, which made its report at the recent meeting of the association in Chicago. The report is published in the Canadian Engineer for December, and doubtless will be disappointing to some who were active in initiating the investigation, if a mere compilation of facts and experience previously gained by others can properly be called an investigation, says the Engineering Magazine.

In sum, the committee report that up to the present time no positive law of the mechanical action and resultant effects upon bridge structures of motive power at high speeds has been formulated, and that it is impossible to even approximately indicate the injurious effects of quickly moving loads on bridges.

The committee, in effect, confesses ignorance of the quantitative values of increased strains to which bridges are thus subjected. At the same time it expresses the full belief that these effects can be measured, and that instruments can be made that will register them. This assertion, however, is accompanied with the opinion that in so broad a field no one committee can ever arrive at conclusions of great value. These statements are made the justification for the compilation embodied in the report as a substitute for the original matter which, the committee seems to think, was expected, since it solicits the indulgence of the association for the deficiency. Classifying attempted determinations of impacts into (a) purely theoretical, (b) those directed to measurement of the stretch of bridge members during the passage of trains, and (c) those directed to the measurement of the deflections of bridge structures as a whole, the committee declares that the theoretical determinations have no interest to the association. Those in class b include tests practically limited to European investigations on riveted bridges, which have shown that impacts on such structures decrease, as spans increase, "in a rather uncertain and erratic manner," and that "the impacts in the various members of the same span are a vague function of the moving load required to cause maximum strain in the member considered."

The instrument invented by Prof. S. W. Robinson for accurately measuring center deflections is favorably spoken of as one means of obtaining accurate information in a general investigation of the subject. Members of the committee made about one hundred tests of the kind included in class b. The results are not included in the report, as they are said not to have been "sufficiently positive." The report well indicates the present imperfect knowledge of effects of impacts of moving loads on bridges.

A CONVENIENT DRILL CASE.

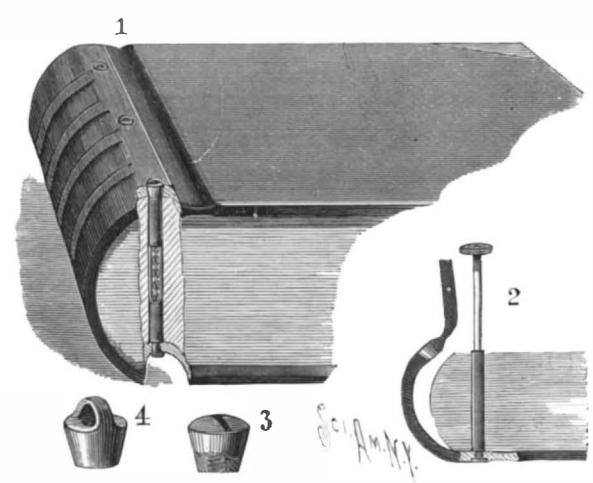
A case in which to keep drills, so that it will always be easy to find just the drill wanted, is shown in the

THE WEISS DRILL CASE.

accompanying illustration. It is manufactured by Louis T. Weiss, Nos. 291 and 293 Graham Street, Brooklyn, N. Y. It has 60 round-bottomed receptacles, from No. 1 to No. 60, No. 1 holding sixteen and No. 60 about two hundred drills. On the raised edge opposite each receptacle is sunk a hardened and accurately ground bushing, forming a drill gage for that receptacle, as shown more plainly in the small figure, the size of each drill appearing in decimals opposite each bushing, and also the size of tap for which the drill is suited. One can see at a glance every drill in the case, and no time need be lost in hunting for a drill or drill gage. The case is made of cast iron, and the cover, when thrown down, will not slam, the hinge bar being a spring, and raising the cover at a touch of the finger.

IMPROVED BINDING FOR BLANK BOOKS.

A binding especially adapted for record books is shown in the accompanying illustration, the binding permitting the convenient removal and replacing of any of the leaves, for the making of entries by means of a typewriter instead of with pen and ink. A patent for the improvement has been issued to Edward M. Wallen (Mrs. Mary B. Wallen, administratrix), Box 43, New Decatur, Ala. Fig. 1 illustrates, in the broken away portion near the back of the cover, the application of the improvement. Embedded in the covers, near the point where they connect with the back, are plates, the top ones resting upon flanges at the bottom of tapering thimbles, and a chain passed through a flexible tube extends from each of the thimbles to an opening in the bottom plate, where it terminates in a head. At the upper end of each chain is a screw extension received by a screw-threaded plug, shown in Fig. 4, the plugs fitting the tapering thimbles, and Fig. 3 shows a plug without a handle, to be substituted



WALLEN'S IMPROVED BOOKBINDING.

for the other variety when the record is completed and the book is to be filed away. To remove a leaf, the plugs are removed, and the cover, with its thimbles, opened back, when rods are screwed on the threaded extensions of the chains, as shown in Fig. 2, the leaves being then passed upward on the rods until the leaf to be removed is obtained, the rods being detached and the plugs restored after the leaves have been returned to their normal position in the book.

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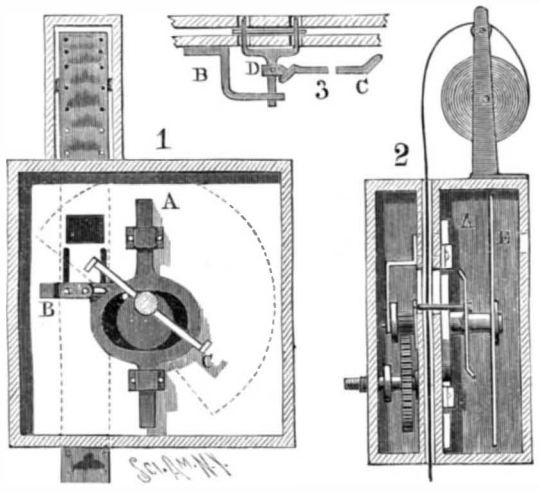
THE LUMIERE CINEMATOGRAPH CAMERA.

The popularity with which the art of moving or chrono-photography has been received has led to the invention of numerous devices for taking the original pictures expeditiously and with as portable and compact apparatus as possible.

One of the most recent cameras of this kind is that invented by the Lumiere Brothers, of Paris, France, which works on a somewhat different plan than that generally noticed and, at the same time, is quite simple and certain in its operations, occupying but little space.

The peculiar novelty of this instrument is the manner by which the film is carried forward intermittently, no sprocket wheel being used.

Referring to the illustrations, the film-moving device (Figs. 1 and 3) will be observed to be nothing more than two prongs arranged like a fork, D, which



Figs. 1, 2, 3.—FILM MOVING MECHANISM.

are alternately pushed through or withdrawn from the perforated ribbon film by a rotating bar, C, having the ends bent in opposite directions, impinging on one or the other sides of a wedge-shaped cam, D, attached to the shank or spindle of the moving fork. The film-moving fork is also attached to an arm of a reciprocating yoke piece, A, actuated by an eccentric (see Fig. 1), so that the moment a section of the perforated film has been carried down by the fork, the fork is immediately withdrawn from the film by the rotating bar, C, impinging the cam, D. The fork is then carried upward by the arm, B, attached to A, clear of the film, the distance of the eccentric movement, until the opposite end of bar, C, strikes the cam, D, and forces the forks into the film perforations; the part, A, then moving downward in the opposite direction, quickly carries, also by the fork, the film the distance of one picture. On the main actuating shaft is also arranged the shutter, E, Fig. 2, which rotates in harmony with the film-moving mechanism. Fig. 2 shows a vertical section of the machine. A is the film-operating part, E the shutter on the main shaft, there being on the rear end of the latter a pinion operated by the larger cog wheel, which is worked by a handle. On the upper end of the box is the supply of the sensitized ribbon, which passes downward between guides before the lens opening. The bent ends of the cam operating bar will be clearly seen. Fig. 4 illustrates the exterior of the instrument, showing more especially the way the film is carried through the machine. The use of the apparatus is shown in Fig. 5, where it will be observed supported on a tripod and its portable nature made manifest. The ingenious device for producing an intermittent movement without sprocket wheels or cogs is one of the features of the camera, while its lightness and facility of operation by simply turning a crank makes it adaptable for use in most any place. Parents with such a camera can preserve all the peculiar antics of their children or of pet animals and numerous other interesting incidents that are constantly occurring. The same camera can be converted into a projecting apparatus for throwing the moving pictures on the screen in regular sequence. The pictures taken with this apparatus are about an inch square. It should not be long before a hand camera based on the same idea should be in use, comparatively automatic, so that every time the tourist makes an exposure it will mean from forty to a hundred pictures at one release of the shutter trigger. The increased interest shown in this class of pictures certainly should stimulate the invention of various forms of portable chronophotographic cameras.

Fig. 5.—THE CINEMATOGRAPH CAMERA IN OPERATION.

Egyptian Archæology.

The Egyptian Museum of Antiquities, which, during Mariette's and Maspero's administrations, was located in the small Boulak palace, and afterward transferred by Mr. Grebeau to Gizeh, has outgrown its present home and is to be transferred once more. Mr. Dourignon, a French architect, has gone to Egypt to assume the direction of the work of construction in collaboration with an inspector of the Egyptian service. The funds needed for this vast enterprise had been appropriated last year, and work was about to begin, when Lord Cromer had all the appropriations laid aside and all the obtainable funds made available for the Dongola expedition. But now, after all, Cairo is going to have its new museum, says the New York Sun.

Such a building is very much needed. Since Mr. Jacques de Morgan arrived in Egypt, as director-general of the antiquities service, it has been his constant dread that all the invaluable treasures intrusted to his care might become the prey of fire. The Gizeh palace, where the museum of Egyptian antiquities is now located, is probably one of the most unsafe public buildings in the world. Its cost was enormous, sending to the shade the extravagances of the Albany Capitol. It was one of the last achievements of Khedive Ismail, when he was preparing Egyptian bankruptcy and his own downfall. I remember noticing, while visiting this palace, large openings in the walls, through which could be detected the composition of the walls, supposed to be made of stone. Instead of compact and solid material, trunks of palm trees, logs of wood, and rubbish of all sorts could be seen, all covered up with a thin outside coating of plaster most brilliantly decorated, a true picture, in fact, of modern Egypt. It was said, also, that the spaces between ceilings and floors were filled up in a similar way with all sorts of wooden debris. The Gizeh palace was in every respect a perfect fire trap.

The probings were made at Mr. J. de Morgan's request, to show to the commission the true condition of things, and the absolute necessity for a new museum, erected in accordance with the rules of a modern fireproof building. The commission and public opinion were so much impressed that the construction of a new museum was decided upon. It is to be erected at Cairo, with a frontage on the Nile, where it will be of easy access to visitors. This will facilitate the more economical transportation by water of the heaviest materials. The plans are simple and at the same time well adapted to the exhibition and safe keeping of antiquities.

Another item of news that will be of interest to travelers in Egypt is that a privilege has been granted by the Khedival government to the Belgian Tramway Company of Cairo to establish a line from that city to the Mena House and the Gizeh pyramids. In building this road the Khaling Canal will be filled up, and it is contemplated that this will improve the sanitary condition of the city. There is nothing so popular in Cairo as a ride on the old road to the pyramids. Every one who has visited Egypt has gone under the shade of its stalwart trees. This old road has a curious origin. It was built at a period of Egyptian history that reminds one of the "Arabian Nights;" when a magnetic Frenchman had brought to the land of the Pharaohs a mighty sovereign to attend the opening of the greatest commercial waterway of the world, fully aware that the canal was not free yet, but still trusting to his star and indomitable will to have it open in time. The ruler of this fairy-like land invited his imperial guest to a carriage ride to the Gizeh pyramids. No road existed from Cairo to the desert, and yet when the sovereigns went to see the pyramids the road was built and planted with shady trees. It had all been accomplished in a few days.

Nothing is more interesting than a talk with Brugsch Bey when the veteran of the memorable Mariette days is willing to entertain you of this strange period. He will tell you how Verdi was called upon by a Khedive's caprice, and "Aïda" written in a few weeks to retrace the old days of Egypt. Nothing was spared to make a more vivid picture of the past. Mariette and Brugsch Bey himself were the stage painters, and the scenes were copied from the genuine records; while

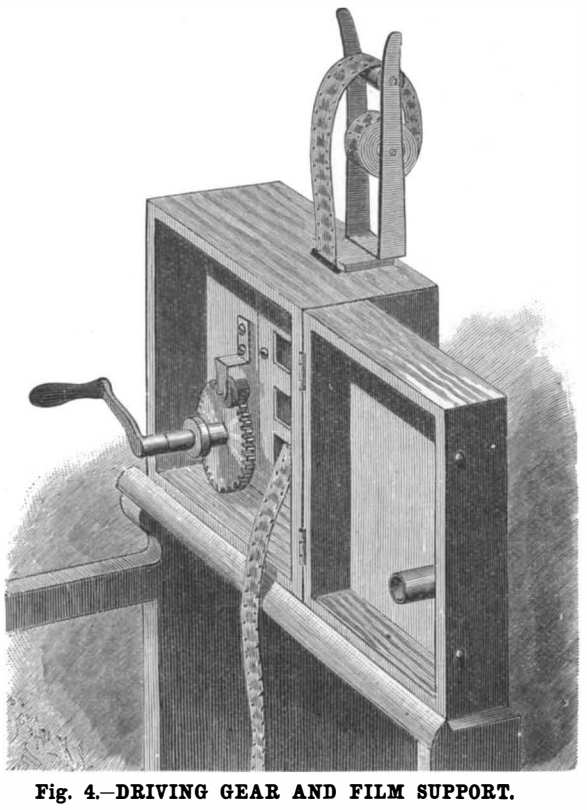


Fig. 4.—DRIVING GEAR AND FILM SUPPORT.

Nubia had to supply ballet dancers and her black cohort. Then the Egypt of the Pharaohs was revived at the will of this modern ruler.

So we will soon have to go to the pyramids in a plain street car. In spite of the majesty of its souvenirs, the Memphis necropolis will become a general picnic ground. But now that it is going to be more accessible to visitors, it is to be hoped that strict rules will be enforced for the preservation of its monuments. Nothing is more destructive to antique remains than tourists in their uncontrollable desire to substitute the world-known names of Jones, Smith and Brown for the less euphonic ones of Cheops, Kephren and Mycherinus. It has been found difficult to keep the base of the pyramids free from debris accumulated by ages; by a judicious tolerance, privileges should be given to tourists to take it away as mementoes, and the task would be accomplished speedily.

Freezing Point of Mercurial Thermometers.

Dr. J. A. Harker, in a paper recently read before the Royal Society on the determination of the freezing point of mercurial thermometers, stated that the method adopted is to cool distilled water in a suitable vessel to a temperature below 0 degree, to insert the thermometer, and then bring about the freezing of the water by dropping in a crystal of ice. The thermometer then rises, and finally attains a steady temperature, differing only very slightly from the true zero. The apparatus employed consists of two portions, the thermostat and the cooler. The former is a copper vessel, filled with either refined petroleum or a strong solution of common salt. The vessel communicates with the cooler, through which the liquid can be pumped by a rotary stirrer, and by this means it can be cooled and maintained for some time at about — 2 degrees. The distilled water to be frozen is contained in a glass tube of about 300 c. c. capacity. This is first placed directly into the circulating liquid, and cooled quickly to —0·5 degree or —0·7 degree. It is then transferred to a cylinder lined with polished metal, placed in the center of the thermostat. The thermometer whose zero is to be taken is then quickly fixed in position, the bulb and a considerable length of the stem above the zero being immersed in the water. A crystal of ice is dropped in, and the temperature quickly rises to the freezing point.

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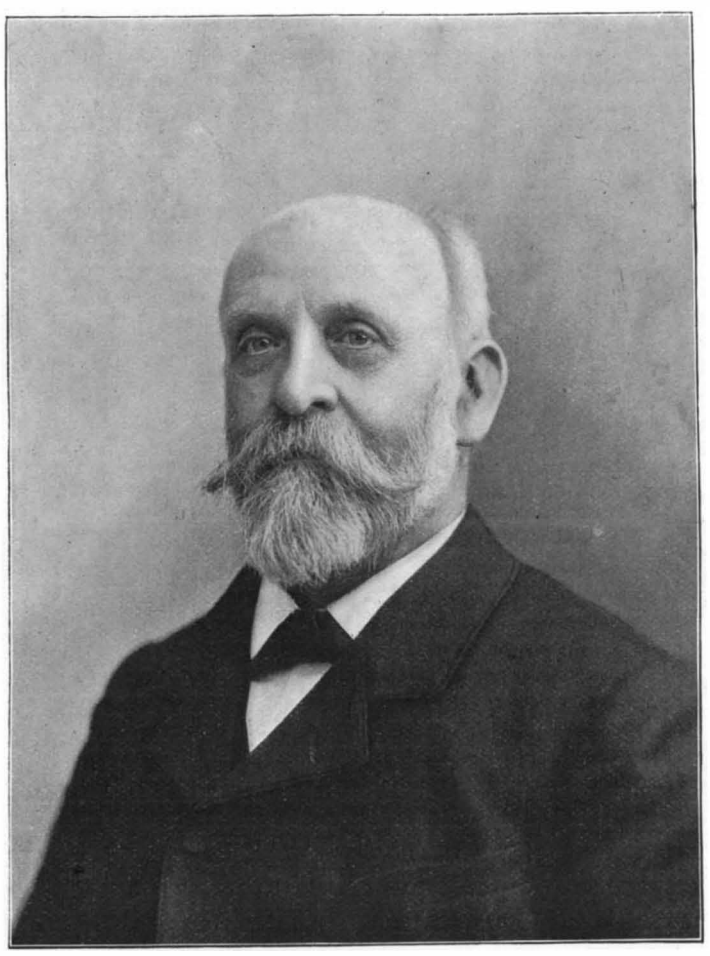
ALVAN GRAHAM CLARK.

In our last issue we gave a brief biographical sketch of Alvan Graham Clark, the famous telescope lens maker and astronomer; now, through the courtesy of the family, we are enabled to present an engraving of the late Mr. Clark, and also give further details of his life and work.

The sudden death of Alvan Graham Clark, the last member of the dynasty of lens makers, came as a shock to all those who are in any way interested in the progress of astronomical science. It is gratifying to note that, though Mr. Clark is the last of the family of expert opticians, the business will not be discontinued on account of his death. For the past twenty-five years, the Clarks have had for their chief assistant Mr. Carl Lundin, who has already achieved a personal reputation for skill and painstaking work. He and his sons will now carry on the manufacture of telescope lenses as before, in the interests of the family of Mr. Clark.

Mr. Clark was descended from old pilgrim stock and was the younger of the two sons. He was born in Fall River, Mass., July 10, 1832. He received a good school education and, developing an interest in mechanical pursuits, fitted himself for a practical machinist. About this time his brother George and his father turned their attention to telescope making and, realizing the possibilities in this direction, Alvan joined the firm which has since become famous under the name of Alvan Clark & Sons. The difficulties in the way of fostering a scientific enterprise are always great, but it is due to the persistence, painstaking and ingenuity of the Clarks, father and sons, that they obtained so great a success. Though no such feats of optical skill have ever been equaled elsewhere as the manufacture of the 36 and 40 inch telescopes of the Lick and Yerkes observatories, yet it was Mr. Clark's ambition, nay, even his expectation, to produce a still more powerful instrument from the largest disks of glass that could be obtained. As it is, the production of the objective of the great telescope of the Yerkes Observatory will remain as Mr. Clark's greatest achievement.

Valuable as were Mr. Clark's services to science as a great manufacturer of telescope lenses, he was also celebrated as an astronomer. He discovered fourteen double stars and he was a member of the expedition which went to Spain to observe the total eclipse in 1870 and to Wyoming eight years later. In 1862, he received the Lalande prize from the Academy of Sciences of France for his discovery of the companion star of Sirius. He was a fellow of the American Association for the Advancement of Science and an honorary member of several foreign societies.



ALVAN GRAHAM CLARK.

A Volcano as a Weather Prophet.

Under the heading "Stromboli as a Weather Prophet," Gaea (Leipsic, September) publishes an interesting notice from which we learn that this volcano has been used from the earliest times, both by mariners and by those who live in its vicinity, as a means of predicting the weather. A recent exhaustive study of the subject, while it does not confirm quite all that has been claimed for the volcano in this line, amply justifies the confidence that has been placed in it. Probably other volcanoes of the same class would give equally trustworthy indications, and it may be that nature has thus been furnishing us with a means of local weather prediction that has been somewhat neglected. The Literary Digest translates below the article referred to:

"Among the Lipari Islands, between Sicily and Calabria, Stromboli is the best known on account of its active volcano, 921 meters [3,000 feet] high. Even in ancient times this served the sailors of the Tyrrhenian Sea as a weather sign. Pliny relates that the inhabitants of the island could tell from the smoke of the volcano what the direction of the wind would be, and Martianus Capella says that the king of the island was Æolus, who knew the changes of the wind from its flame and vapor. These tales are true in so far as the smoke column of the volcano, ascending, as it does, far into the upper air, can give indication of the air currents that prevail there, before these have made themselves felt on the ground. Later on, Stromboli became still better known as a weather prophet, and Dolomieu, who in 1781 visited the Lipari Islands, tells us that in general this volcano is noticeably more active in winter than in summer, and also more active on the approach of stormy weather than in a calm. Spallanzani, who visited Stromboli in 1788, investigated the weather indications that the inhabitants had derived from the volume of smoke and the brightness of the flame of the volcano, and found by actual observation in seven cases that these rules for the most part were not trustworthy. The well known expert in vulcanology, Poulett Scrope, was led to believe in a connection between the activity of Stromboli and the atmospheric pressure, because an alteration of this pressure must alter the balance of the expansive forces in and under the crater. Judd also regards it as beyond doubt that in stormy weather, and especially in winter, the eruption of Stromboli is most violent, and he cites the testimony of the islanders in favor of this. The same opinion is held by Mercalli, who ascribes to meteorological conditions a preponderant influence on the activity of the volcano. Quite recently Alfred Berget, of Munich, has taken up the question anew, and in 1894 he made a long geological study of the Æolian Islands. In a paper in the Proceedings of the German Geological Society, he describes his own observations on the alleged connection between the changes of atmospheric pressure and the activity of Stromboli, from which it appears that such a relationship is unrecognizable. Moreover, he has compared all the eruptions of Stromboli since 1881 with the condition of the atmospheric pressure, and has found that there is no evidence for the hypothesis that the energy of the volcano increases with diminution of the pressure, nor can any lowering of activity be shown to follow upon a rise of the barometer. Finally, he also found that the list of eruptions given by Mercalli cannot safely be depended upon. He also carried out a theoretical investigation of the subject, that led him to the conclusion that no noteworthy influence on the activity of the crater can be ascribed to the pressure of the atmosphere, although it has been regarded by some as a natural barometer. But how about the popular belief, which regards Stromboli as a weather prophet? Dr. Bergert answers this question as follows: He notes that this belief has to do only with the smoke that issues from the volcano. It is, he says, water vapor, which seems to envelop the summit of the volcano as a cloud. If moist masses of air blow over Stromboli, the vapor that rises from the volcano will become more clearly visible than when dry winds are blowing in the upper regions of the air. In this way the volcano acts as a very sensitive hygroscope and at the same time as a weather vane also, and by the combination of its indications . . . skillful mariners have for a long time been able to derive trustworthy prognostications of the weather. 'When the air is moist,' says Dr. Bergert, 'if the cloud of vapor over the volcano's summit is thicker, the reflection from the light that shines upward through the crater will also be more evident, which was probably what gave rise to the idea that the volcano is more active in stormy than in clear weather.' The question by what conditions the eruption of the volcano is influenced is at present not to be answered with certainty. Bergert believes that Mercalli was right when he regarded the varying activity of such a volcano as Stromboli to depend chiefly on the stoppage of the lava channel and the subsequent clearing out of it. Bergert expresses the hope that an observatory may be established on the isle of Æolus for the special observation of its volcano, so that the action of meteorological causes may be clearly separated from other influences on the varying activity of the volcano."

AN observatory at Odessa is to be established as a branch of the observatory of Pulkowa.

The Basilicas of Rome.

Christianity was emerging from catacombs and hiding places and ousting the heathen worship everywhere. In the region "over the Tiber" they had been grudgingly allowed to worship in some building where now stands the basilica of Santa Maria in Trastevere. The edict of Constantine left them free to worship in public: the temples were deserted in Rome, though heathen rites expired more slowly in the villages, and the question at once arose, What buildings should they worship in? The temples were objectionable from their associations; they were rejected. Not so, however, their materials; this must be borne in mind, as it exercised an immense influence upon the future designs of churches. Columns and bases, but especially the former, were freely had recourse to when building operations began. But at first they were well content to use the structures allotted to them by the Christian emperor. These were the basilicas.

The word is derived from the Greek basilike, "royal," and in early times probably meant the place where the ruler himself administered justice. In Rome they were used as law courts, though commercial business was often transacted in them besides. There were many in the city, some on a scale of great magnificence, usually situated near the different fora or market places, and named from their founders the Æmilian, the Porcian, the Julian, after the first Cæsar, and the Ulpian, which is represented on a coin of Trajan. An approach through a colonnaded court was sometimes provided, and, in common with the practice of most ancient cities, they were rarely quite isolated. The building was usually oblong in plan. On entering, the visitor saw on either hand a line of columns dividing the structure from end to end into three sections, the center, called from its long, narrow shape the navis, or ship, the side alleys, much narrower, aisles. These are the original "nave and aisles" of our modern churches. At the far end the wall was curved into a deep apse, a semicircular recess covered by a half dome or "shell" (concha) which it resembled; in its center, upon a narrow platform approached by steps, was the judge's seat. Here he sat looking down the building and facing the entrance; on either side were his assessors, their curving stone seats filling the rest of the semicircle. Over the side aisles were galleries. The roof of wood, and not as yet vaulted, rose very high over the central nave, high enough for small round headed windows (unglazed) to clear the lean-to roofs which covered the galleries, thus acting as a clear-story to light the building. It is probable that there were no other windows at first, but those who have seen how easily a structure is lighted in Italy will not wonder at this; sometimes a single window—the others having been bricked up or partly obscured by curtains—will suffice to flood a church with light.

Greek and Roman buildings can scarcely be said to have had windows; they play no part in the designs of the public edifices, while private dwellings were built round courtyards. The original purpose of the apse is preserved in the Italian word tribuna, used for chambers and structures of this shape. Its raised steps were sometimes so high that rooms were built underneath them, though for what uses is unknown. Under the entire pavement of the hall a heating chamber, with the usual Roman furnaces, was generally provided. Where the judge had sat the bishop was now enthroned; his clergy occupied the half circle of seats to his right and left. The galleries were appropriated to the women, and in some cases there were separate seats for the unmarried, married, and widows. These halls, thus suddenly invested with extraordinary interest, were not planned with any particular direction; they arose as circumstances demanded, and being turned into churches, the old doors were still used. It may be for this reason, but the custom of "orientating," or turning churches to the east, is almost unknown in Italy. St. Peter's, for instance, is entered from the east end, and not, as with most of our churches, from the west. The materials of the old temples were abundant on every side; the walls would be of little use, but columns and architraves were taken by scores. And an extraordinary use was made of them; for as the original basilicas were superseded by new ones, "basilica" thus becoming synonymous with "church," a conflict began between the traditions of the orders and the wants of the new worship.—Temple Bar.

MR. LAWRENCE BRUNER, of the University of Nebraska, has sailed for the Argentine Republic to study the ravages of the locust, which have recently developed into a terrible pest, certain regions being completely devastated by them. The Argentine government has granted $400,000 for relief, and a syndicate of business men have raised the funds to employ Mr. Bruner to investigate the subject from the entomological side.

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Correspondence.

The New Supplement Reference Catalogue.

To the Editor of the SCIENTIFIC AMERICAN:

Many thanks for the SUPPLEMENT catalogue. It is indeed a valuable aid to quickly find the articles in the SUPPLEMENT. I have nearly all the numbers of SCIENTIFIC AMERICAN and SUPPLEMENT and constantly use them for reference. They have been of greatest value to me in the study of natural sciences.

Rev. MARCUS KIEK.

St. Francis Seraphicus Convent, Cincinnati, June 11, 1897.

Death of Father Kneipp.

Father Sebastian Kneipp, the genial old priest whose water cure, or grass cure, made him famous, died at Woerishofen, Bavaria, on June 17, in the seventy-sixth year of his age. Father Kneipp was a unique figure in the history of the healing art. His fame came from his original method of treating diseased persons by means, chiefly, of cold water applied in a variety of ways. He practiced the cure for over a lifetime, although it came into general vogue only in the last five years. He was born in 1821, and after leaving school worked as a weaver until the age of twenty-seven, when he began to study medicine and theology, having long desired to become a priest. He was in ill health, and in a delirium of fever he rushed from his room and thrust his feet through the ice in a pond, and instead of becoming worse found he was much better for the shock, and so began systematic experiments along this line.

He was admitted to holy orders and went to the village of Woerishofen in Bavaria, where he earned the love of his neighbors and the mountain folk, whom he had cured of disease by the cold water treatment. His fame was for a long time local, but in time it spread all over the world, and people came to him for treatment in large numbers. The doctors looked askance at the spectacle of a priest making use of the methods only ascribed to a charlatan, but he really was no charlatan. At last notable persons began to come to him for treatment. Emperor Francis Joseph took a course of it on two occasions. The Archduke Joseph of Austria also underwent the cure, and it was an amusing sight to see some of the notables of Europe walking barefoot in the dewy grass in frock coats and white cravats. This barefoot walking became the best known system introduced by Father Kneipp. His belief was that most illness was the result of the luxury of modern living, and his aim was to improve the circulation and tone up the system. He made use of local bathing and applications together with steam baths which were sometimes medicated with herbs. To stimulate and restore the circulation, he ordered the barefoot walking and cold douches. He always made it a point to see his patients himself, and he made no charges for his services. Contributions from relieved patients he used for parish work. For a long time there were not accommodations for the visitors in the village; but this has been remedied. In recognition of his work, the Pope bestowed on Father Kneipp an honorary office, which carried with it the title of Monsignor. In 1894 the Monsignor was called to Rome to treat the Pontiff, and it was announced after some time that, by his treatment, the Pope's health had been restored. Kneipp societies have been established in most countries of the world. The method of treatment has made some headway in the United States.

The Work of the Postal Congress.

The fifth convention of the Universal Postal Congress adjourned at Washington, June 15. It was decided to hold the next meeting at Rome, Italy, in February, 1903. The final sessions were devoted to the signing of the general treaty, which becomes operative on January 1, 1899. Each delegate signed these papers subject to the formal ratification of his government. The originals will be deposited in the archives of the state department and certified copies will be sent to all the governments comprising the Universal Postal Union. The following is an official resume of the results of the work of the Congress:

1. The principal treaty, which includes the entry of Corea into the Postal Union; the declaration of the Orange Free State (which failed to send a delegate to Washington) that it hoped soon to enter the union; and the declaration of the Chinese empire (which was represented in the congress) that it will observe the regulations of the union as soon as the organization of its service permits.

2. The conditions in which the countries of the union will pay reciprocally the intermediary transit rates have been facilitated, and tariff diminished quite materially on a graduated scale for the ensuing six years.

3. Uniform colors have been projected for postage stamps.

4. Postal cards unpaid are subject to a double tax, that is, four cents in the place of the former tax, which was ten cents, the same as for unpaid letters.

5. Circulars produced on a machine (typewritten) in quantities of twenty circulars, all of the same character, are admitted to the international mails at the same rates as printed circulars.

6. Samples of merchandise are admitted up to 350 grammes.

7. Objects of natural history, animals, dried plants, or preserved geological specimens are admitted as samples.

8. The question of the creation of a universal postage stamp brought up, and the proposition defeated, on account of the difficulties which would occur in putting into practice that important innovation, especially because of the diversity of currency standards.

9. Special arrangements concerning packages of declared value, postal orders, books of identity, and subscriptions to journals have been thoroughly revised. (This country is not actually concerned in these arrangements, mostly affecting the states of the Continent of Europe.)

Recent Patent and Trade Mark Decisions.

Warner v. Stimson (Decision of Secretary of Interior. 78 O. G., 1901.

Jurisdiction of the Secretary of the Interior over Judicial Acts of the Commissioner of Patents.—The Secretary of the Interior has no jurisdiction over acts of the Commissioner of Patents that are judicial in their nature. To construe and apply a rule of the Patent Office is a judicial act. At any rate, appeal will not lie to the Secretary of the Interior over an interlocutory order of the Commissioner of Patents.

Jenkins v. Jenkins (Decision of Secretary of Interior), 78 O. G., 1902.

Judicial Act of the Commissioner of Patents.—The decision as to whether an interference will be allowed to proceed or not is judicial in its nature, and likewise the question whether any one may be a proper party to an interference, and in either case appeal does not lie to the Secretary of the Interior.

Diamond Match Company v. Hanover Match Company (U. S. C. C., Pa.), 78 Fed. Rep., 622.

Match Making Machine.—The Sisum patent, No. 281,408, for a machine for bundling match sticks, has been held valid as to claims 1 and 10 and to be entitled to the liberal application of the doctrine of equivalency. The Donnely patent, No. 292,474, for a match-making machine has been held valid as to claim 2.

Fowler v. Dodge (Commissioner's Decision), 78 O. G., 2045.

True Inventor of Linotype Machines.—Joseph C. Fowler has been held to have been the true inventor of the linotype machine set forth in his application filed October 1, 1893, as against the application of Philip T. Dodge.

Sufficiency of Disclosure.—The drawing or other disclosure of an invention must be clear enough to enable one skilled in the art to construct a machine, and the specification may fail in this while showing an adequate and complete conception of the invention.

Reduction to Practice.—Where the specification and drawings are sufficient to show an intellectual conception of an improvement, but not clear enough to enable those skilled in the art to make the machine, the filing of the application does not amount to constructive reduction to practice.

Arnold v. Tyler (Commissioner's Decision), 79 O. G., 154.

Reduction to Practice.—Reduction to practice may be made with an experimental device, if it be by practical and successful operation and in such use as it would have to stand when manufactured. The use of a shoe last in trimming soles is not a reduction to practice of the same last for leveling soles, where the conditions are different and the strain is greater. Where the device was laid away for four years without use, there is a strong presumption that it was merely an unsuccessful experiment in the former alleged use, and the claim that the party was, during the four years, trying to devise means to make the device practical is inconsistent with the contention that such device was in its first use a complete reduction to practice. The fact that the applicant made inquiries as to the patentability of the device is immaterial to the question of reduction to practice or of due diligence therein. Delay for four years is conclusive evidence of lack of due diligence in reducing a simple device to practice, at least where the party had ample means.

An Airship Takes Fire.

A dispatch from Berlin, dated June 12, states that Herr Woelfert, a noted aeronaut, and his assistant Knabe, made an experimental ascent in a steerable airship from the Tempelhof field. When the balloon, which had been filled at the military ballooning establishment, had reached a considerable height, estimates of which vary from 1,700 to 3,000 feet, a loud explosion occurred, and the next moment the balloon was seen to be ablaze. The car, which was also on fire, detached itself from the burning silk and fell with fearful rapidity to the ground. Both of the occupants were found to be dead. Their bodies were horribly burned. It appears that the benzine used in the steering motor exploded, causing the disaster.

Science Notes.

The Ameriean Academy of Medicine held its twenty-second annual meeting on May 29 and 31, at Philadelphia. It was largely attended.

It is said that some of the heirs-at-law of the late Alfred Nobel are contesting his will, by which he bequeathed his property for the advancement of science.

Dr. Charles W. Dabney has been appointed special agent in charge of the scientific and statistical investigation of the United States Department of Agriculture.

The Carlsberg fund for scientific purposes has offered about $40,000 to the Danish scientific expedition to the east coast of Greenland, for the purpose of making a chart of the coast northward to Angmagsalik.

At a recent meeting of the Academie des Sciences, in Paris, M. Henri Moissan communicated the results of his experiments with Prof. Dewar in the liquefaction of fluorine gas. We have already referred to this interesting experiment. Though solid fluorine has not yet been obtained, M. Moissan is sanguine that this astonishing result will also be secured.

An interesting discovery from a geological point of view was recently made by an explorer in the mountains of Witzies Hoek, Natal, says Le Génie Civil. On the summit of an extinct volcano, on the edge of a lake that occupies the crater, soundings revealed a layer of sand inclosing small diamonds. It would be interesting to know whether these diamonds were there accidentally, that is, as the result of washing operations carried on by the natives, or whether this discovery corresponds to an actual mine of diamonds, for the hills of Witzies Hoek are not situated in regions known to be diamond bearing. On this last hypothesis, the presence of precious stones in the crater of a volcano would doubtless throw some light on the formation of the gems in nature.

Mr. J. C. Merryweather, the well known manufacturer of fire apparatus in London, makes a most useful suggestion on the subject of the protection of churches from fire. After referring to the dangers of fire in such buildings from defects in the heating and lighting apparatus, he proposes that each church tower should be fitted with a tank or tanks, kept full of water by means of a pump and hose or fixed pipe, the pump to take supply from a well or other available source. From the tanks he suggests a pipe being carried into the church, with hydrants and hose in convenient positions. The water tanks would then enable powerful jets to be brought to bear immediately an outbreak of fire was discovered. The cost of the arrangement would be small, and doubtless the destruction of many sacred buildings by fire would be prevented. Canterbury Cathedral has been saved three times by its own fire apparatus, and the recent fire at St. George's, Hanover Square, proves that even in London there is considerable risk of fire in places of worship.

In his second lecture on "Liquid Air as an Agent of Research," delivered at the Royal Institution, says The Engineer, Professor Dewar continued his remarks on the critical constants of gases, and brought forward some interesting speculations founded on this extension of certain laws, known by experiment to hold good at accessible temperatures, to bodies which one could never hope to be able to examine in the liquid state. With regard to the theory that carbon is a very important constituent of the sun, he pointed out that the density of the latter was 1·4. Supposing it to consist of carbon at the critical temperature, its density when cooled to liquefaction would become 4·2, according to known laws, and if it were cooled to the temperature of this earth, its density would increase by something like one-quarter. Therefore, the density of the materials of the earth—which was 5·5—did not appear to be far removed from the density of the sun at the same temperature. The lecturer, for the first time in public, froze a specimen of argon, supplied by Lord Rayleigh, to the solid state by means of liquid air at a temperature more than 200 degrees below zero.

Working in the physical laboratory of the Massachusetts Institute of Technology, Mr. R. W. Wood has succeeded in producing diffraction phenomena with Roentgen rays, says Nature. The source of the rays was an arc-like discharge between two very small beads of platinum in a high vacuum. The discharge bulb was only about an inch in diameter, while the radiation—which came from an area about the size of a pin head—was strong enough to show the bones in the forearm. The "arc" appeared to be a new form of cathode discharge, and could only be produced under peculiar conditions. Mr. Wood used a tube with a platinum slit 0·1 mm. wide, mounted within the bulb at a distance of 2 mm. from the radiating bead. The second slit of variable width was placed at a distance of 10 cm. from the first, and the photographic plate at distances varying from 10 to 30 cm. from this. The images of the slit on the plate showed a distinct dark line on each edge, which could only be explained on the supposition that interference occurred. The plate was at too great a distance from the slit for such an effect to be produced by reflection of the rays from the edges. Images of fine wires showed similar phenomena.

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THIRD RAIL ELECTRICAL EQUIPMENT OF THE NEW YORK, NEW HAVEN AND HARTFORD RAILROAD.

(Continued from SCIENTIFIC AMERICAN of June 12, 1897.)

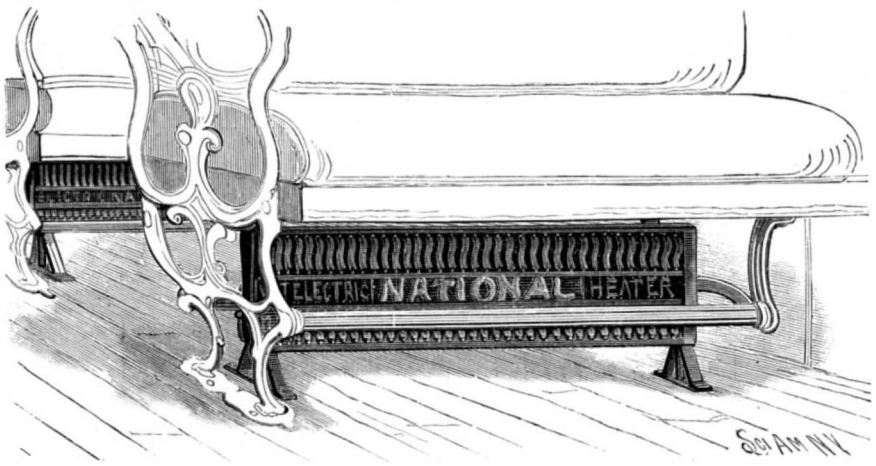
In our previous notice of the electrical equipment of a portion of the lines of the New York, New Haven and Hartford Railroad we stated that the power house at Berlin was a plain rectangular structure 106 feet in width by 117 feet long, the sides and one end being of brick, the other end being temporarily boarded up until the building shall be extended and completed. The building is divided longitudinally by a brick partition wall; the front portion, or that facing the tracks, is two stories in height, the engines and dynamos being installed in the upper story and the heaters and various accessories in the basement. The rear half constitutes the boiler room. Interior views of these rooms will be found on the front page of this issue.

At present the engine room contains a 1,200 horse power engine of the cross compound type, with a 28 inch by 48 inch high pressure cylinder and a 48 inch by 48 inch low pressure cylinder. The flywheel is 18 feet in diameter and weighs over 52 tons. The engine dynamo shaft is of hollow steel, and the engine is direct connected to a General Electric Company's standard 10 pole, 850 kilowatt generator of the ironclad type.

The switchboard shown in the accompanying illustration is set in a bay built out on the front of the building. It is of the standard panel type of the General Electric Company and contains seven panels, of which three only are at present equipped. Two of these are generating panels and the third is a totalizing panel. Upon the former are automatic circuit breakers of extra large size, with magnetic blowout and the usual generator panel equipment; the totalizing panel carries a Form G Thompson 5,000 ampere recording wattmeter and an 8,000 ampere station ammeter. Four cables, each of 850,000 circular mils cross section, run from the switchboard to the third rail.

The boiler room contains ten horizontal tubular boilers, which type has been selected on account of its "simplicity, high economy, and general reliability." In setting the boilers, care has been taken to provide for absolutely free expansion in all directions, and especially in a direction transverse to the axis of the boilers. It will be seen from the illustration that the boilers are suspended from two pairs of I beams, which rest upon the brick partition walls, the suspension rods being linked to straps which are riveted to the shell of the boiler. The great height (48 inches) from the fire bars to the boiler is a noticeable feature, and it was adopted in order to secure a more thorough combustion and a slower passage of the gases to the uptake. It is claimed that with judicious firing the uptake temperature has been kept considerably below the normal for this type of boiler. The grates are designed for burning the half burned coal known as "sparks," which is recovered from the fire boxes of the locomotives of the New Haven road. As there are several hundred tons of this material produced every month, it can be understood that it is an extremely cheap fuel as delivered in the bins at the power house. The pipes which lead down through the partition walls and below the grate are for introducing a mixture of steam and air to supply the necessary oxygen for combustion. Each pipe is slightly flaring at the top, and contains an annular steam pipe perforated on its under side. The gases pass from the boiler tubes to a rectangular flue, which extends the full length of the nest of boilers, and delivers into a cross flue 5½ feet wide by 8 feet deep, which leads to a chimney 125 feet in height on the outside of the building. The "sparks" is delivered into a row of bins located on the outside of the boiler house, and from these it is drawn off as required into small trucks, which run on a track parallel with the wall of the building. From this track it is switched on to another track, which runs at a convenient distance from the furnaces. The fuel is shoveled directly from the trucks into the furnace. Swinging trucks are also provided for carrying away the ashes. Special care has been taken in designing the boiler fronts, which are held in place by clamps, and may be taken down separately in a few minutes by loosening the clamps—an arrangement which will commend itself to practical men at first sight.

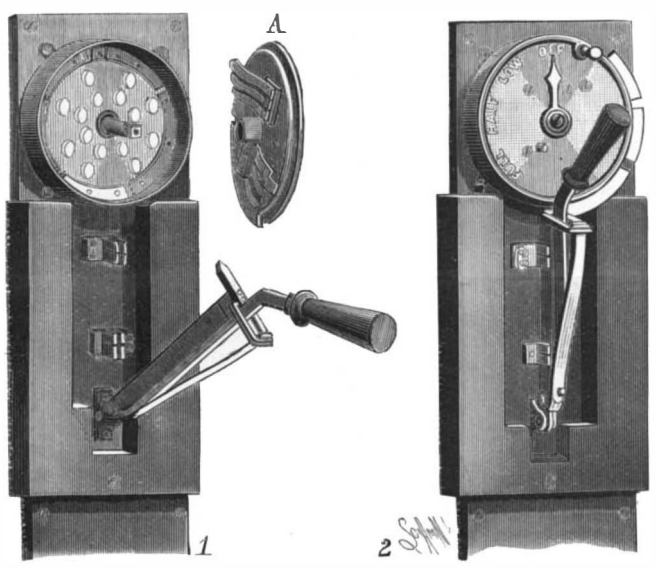
Another point which has received special attention is the arrangement of the steam piping. Col. Heft does not believe that it is good policy to put in a costly duplicate system of piping, and he is of the opinion that satisfactory results may be obtained by exercising care and good judgment in the design and erection of a single system. Accordingly, every provision has been made for free movement of the piping under expansion and contraction. In the first place, a 20 inch wrought iron header runs the entire length of the boiler room, at a height of eight feet above the boilers. It has a free longitudinal movement upon rollers, which are carried upon brackets attached to the central partition wall of the building. Each boiler is connected with the header by a heavy seamless copper 9 inch pipe bent to a radius of 8½ feet. The throttle valves are placed at the junction of these pipes with the header, the valves being all of the balanced type. Steam is led to the engine by 12 inch wrought iron pipes with bends of large radius. The piping of the accessory steam plant is so arranged that the engines may be run as condensing or non-condensing. Each side of the engine can be run independently and the feed may or may not be heated, at the option of the engineer.



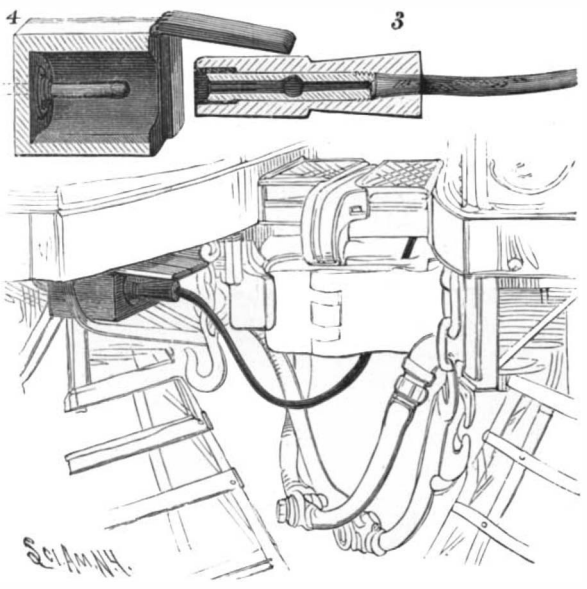
ELECTRIC HEATERS FOR CLOSED CARS.

In the illustration showing the various car couplings will be noticed the electrical car coupling or connector-box. In the earlier experiments considerable trouble was experienced at the exposed point where the wires entered the motors, and the connector box was designed to overcome the difficulty. The connection consists of a hollow brass tube, split at the outer end to give it a tight grip of the motor wire, and incased in a wooden plug. There are two of these and they enter a connector box located beneath the front end of the platform, as shown in the engraving, the box being closed by a lid when it is not in use.

The closed cars are each provided with sixteen electrical heaters, which are placed beneath the seats as shown in the sketch. The degree of current and therefore the temperature is regulated by means of an electrical switch of special construction. There are four graduations on the dial: full, half, low, and off. The dial, which is movable, has the brushes attached to its inner face, and these move upon a series of contacts on the fixed plate. In order to reduce the spark on opening or closing the switch, the switch lever is formed separately from the knife, the former being hinged to the latter near its junction with the switchboard. Normally the knife is held against the lever by the tension of a plate spring; but when the lever is pulled open the two are separated, the knife snapping suddenly against the lever as it leaves the contacts and reducing the duration of the spark.

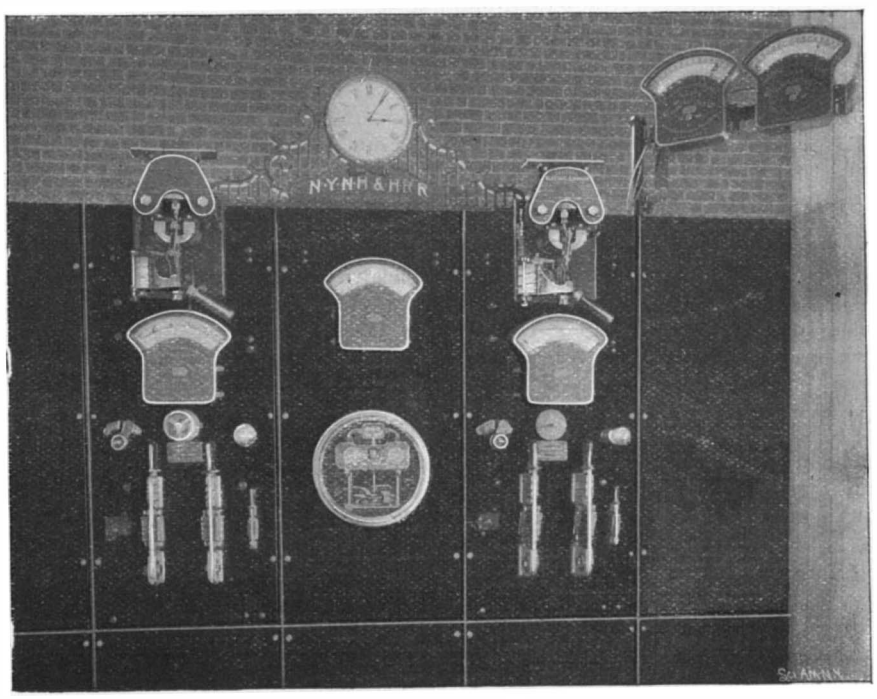


SWITCH FOR ELECTRIC HEATERS.



ELECTRIC CAR COUPLING.

The heaters in each coach are connected in series with each other and form a complete circuit extending down on one side of the car and up on the other, in which all of the sixteen heaters are included. This circuit, known as the series wire, has no connection with the heat-regulating switch, neither is the positive (trolley) nor the negative (ground) side of the current supply permanently connected to any portion of this circuit. A variable ground and trolley connection is carried by the regulating switch and can be applied by means of tap wires to one or more points of the series wire or circuit, according to the amount of heat required. As the heat generated is directly proportionate to the amount of current flowing through the wires of each heater, and as this flow of current is governed by the combined resistance of the heaters through which the current must flow, it is but necessary to vary the number of heaters between a point where the current enters and where it leaves again in order to regulate the temperature to any desired degree.



SWITCHBOARD, BERLIN POWER STATION.

India's Severe Earthquake.

Dispatches from Calcutta, dated June 14, state the gravity of the earthquake shocks of June 12. An extensive area was affected and much misery was caused among many of the poorer Europeans and natives. The shocks were felt over a large territory and traffic on the Eastern Bengal Railroad was interrupted. Bridges have been damaged and a train was overturned on the Assam-Bengal line. The heat prevailing is the highest on record, 126 degrees in the shade having been registered at the Jacobabad, on the frontier of Belochistan.

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THE MECHANICAL BASEBALL PITCHER.

We present some engravings of Prof. C. H. Hinton's mechanical baseball pitcher. This new gunpowder gun for pitching a baseball was tried at the Princeton ball field on June 8, 9, and 10. The apparatus was put into position and expert players were allowed to bat the ball. The result of the test was very successful, the ball being discharged by electricity. The tension was varied and drop and curve balls were discharged by the gun with ease. Prof. Hinton has provided us with the following description of his interesting mechanical pitcher. He says:

The problem of producing by inanimate mechanism the equivalent of a ball pitched by the human hand divides itself into three parts.

First, the projection of a ball so that its velocity varies within narrow limits, and its direction is accurate.

Secondly, the imparting to a ball so delivered a spin or rotation about an axis which does not coincide with the direction of flight, but lies at right angles to it.

Thirdly, the providing an equivalent or substitute for the motion of the pitcher's arm preparatory to the delivery of the ball. The most natural plan to pursue in seeking to reproduce a pitched ball by inanimate mechanical means is to construct a catapult.

An instrument of this kind capable of projecting a fairly accurate straight ball is not difficult to make, but when it comes to combining a rotator with the projecting apparatus, the problem assumes a different aspect. And even if a solution were arrived at, the construction would, for the special purpose for which it is designed, be impracticable, on account of its cumbrous nature.

The moving parts and guides must, in their weight and friction, far exceed the inertia of the ball, and a source of energy vastly disproportioned to the effect produced would be needed.

Such, at least, were the considerations which led me to abandon the construction of a catapult pitcher and to adopt the expansive force of gunpowder acting behind the ball in a tube, as the source of projectile force.

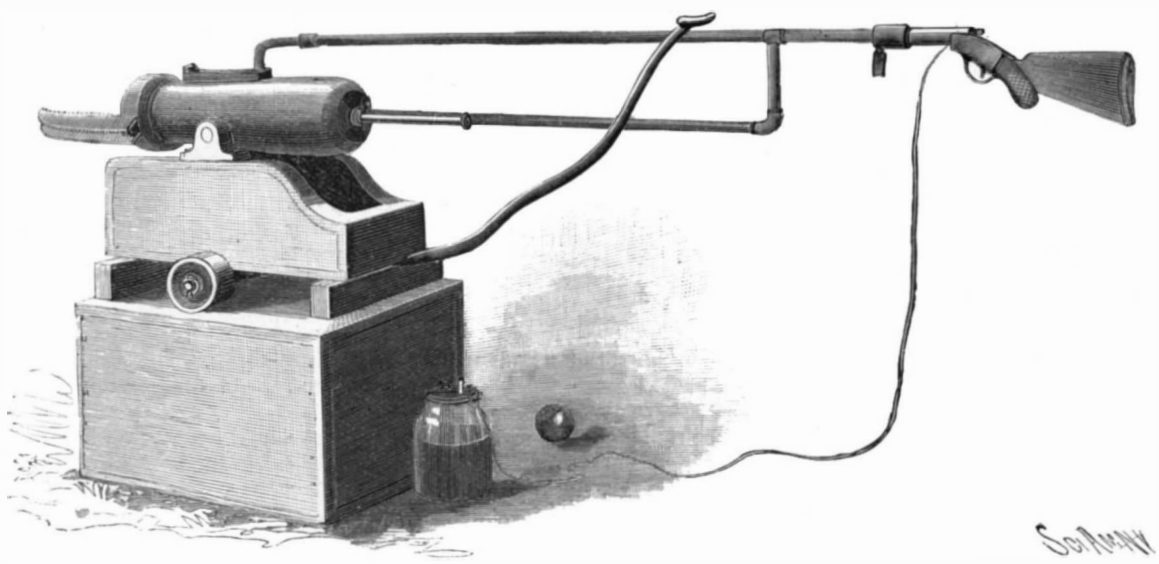
With the simple and satisfactory means, however, of producing rotation described below, a catapult form of pitcher does not seem to be at all impossible.

Adopting powder and a tube, it is by no means the case that a true and accurate ball can be produced without further thought.

If the powder is ignited in a small chamber behind the ball, the most varied effects follow. The ball sometimes fails to travel its course, sometimes flies with prodigious velocity. When a short barrel is used, the results are better; but the most absolute accuracy in loading and uniformity in wadding are requisite. The whole condition, however, changes as soon as a long tube of small caliber is traversed by the exploding powder before it emerges into the large barrel in which the ball is held.

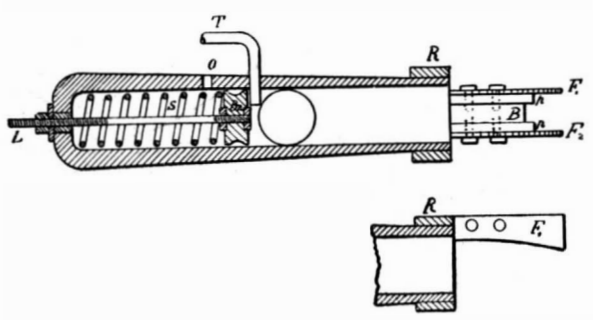
With such an arrangement, the difficulty of sending one ball after another with a uniform velocity disappears. In the experimental model and in the light gun, illustrated herewith, a tube of $\frac{38}{100}$ inch internal diameter and of a length of about 4 feet is used. The results would probably be still better and more uniform with a tube of 30 caliber, the length being the same.

It is certain that a tube of 44 caliber, even though a little longer, is comparatively extremely unreliable. The tube may be straight or coiled. If coiled, a slightly heavier charge is needed. The reasons of the effectiveness of the long tube appear to be two: In a long tube, the complete combustion of the powder is secured and the maximum amount of gas in each case produced. With such a tube, also, the delivery of the expanding gases on the ball is effected without shock. A baseball is elastic. If an elastic body is hit a violent blow when confined in a tube, its lateral expansion causes it to jam, and when released from its momentary arrestation the gases heaped up behind it urge it on with great velocity.



THE BASEBALL CANNON.

A straight ball of fairly uniform velocity being thus obtained, the rotation round an axis perpendicular to the line of flight is obtained by prolonging the inner surface of the tube in two separate lines widely distant from each other, so that when the ball leaves the barrel it is touched in two spots and retarded by the prolongation of the tube. This is effected by means of "fingers," thin plates of metal, which, fastened to a ring movable round the muzzle of the gun, project over the thickness of the barrel, so that their edges are in a line with the interior of the tube.



CROSS SECTION OF THE BASEBALL GUN.

These fingers are curved and covered with rubber. The ball, on leaving the barrel, owing to their curvature presses itself against them more and more. Owing to the nature of the substance with which they are covered, the ball slips very little. It tends to roll, and roll, not on a full circumference, but on two small circles near the poles. It thus obtains a velocity of spin greater than that which it would have if it traversed its course rolling against a surface instead of flying through the air. This spin gives it the curved path.

The cap which carries the fingers can be turned round on the muzzle of the gun so that any required curve can be obtained.

The ball curves in that direction toward which the front is moving. Hence, if, looking along the gun, the fingers are put on the right hand side, the curve will be an in curve, that is, toward the observer's right hand.

With fingers seven inches long, slightly curved, and covered with one-eighth inch rubber, the gun will send balls varying from right to left of a mark by only a few inches, and making a curve of nine or ten inches deviation from a straight line.

With fingers more strongly curved, the deviation of the ball is greater, but the accuracy is impaired. Probably with longer fingers of slight curvature a greater deviation could be obtained without loss of accuracy.

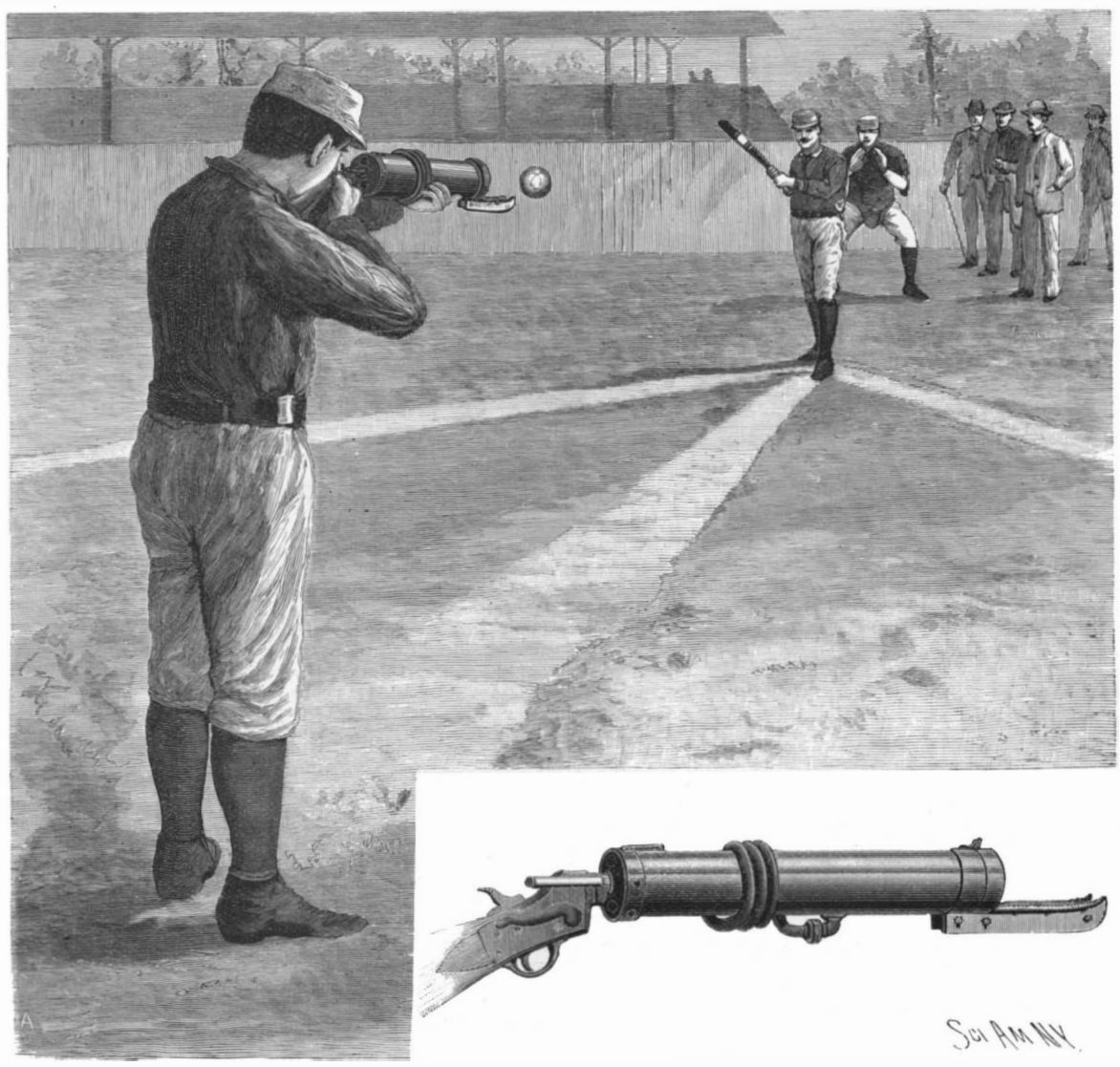
In order to obviate any dangerous velocities, and thus make the gun perfectly safe, the breech, which closes the barrel immediately behind the tube for the delivery of the expanding gases, is made movable. It fits easily in the barrel, and the necessary obstruction to the powder gas is secured by means of packing. The breech is pressed forward by a spring coiled in the part of the barrel behind it. The spring is so regulated as to press on the movable breech with the same force that the powder does when driving the ball at such a rate as to traverse 60 feet in six-tenths of a second, that being the speed at which a ball of fair velocity is pitched. If, for any cause, the pressure in the barrel becomes greater than that necessary to produce this velocity, the breech is pressed back and an aperture in the side of the gun is thereby made accessible to the gases, and thus the pressure on the ball is relieved.

Without the movable breech, a ball which fits tightly in the barrel is a possible source of danger, on account of the high velocity with which it is propelled. With it a tightly fitting ball is driven out more slowly than one which fits properly.

The breech is kept in place against the spring by a rod passing through an opening at the end of the gun, and secured by a nut.

Variation of speed without a change of cartridge can be obtained by shifting the position of the breech. If it is drawn back so as to leave a space behind the ball, a "windage" is provided, which moderates the speed.

There are difficulties, however, of a psychologic nature in the way of the successful use of the gun as hitherto described. The ball comes too suddenly; there is nothing to compensate for the motion of the pitcher's arm. As a substitute, signals of various kinds have been tried, but an effective plan, and the one at present adopted, is to dispense with the necessity of signals



GUN FOR DELIVERING A CURVED BALL AS USED ON THE PRINCETON BALL GROUNDS.

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altogether. By means of a very simple electrical arrangement the batter fires the gun himself. When throwing his foot forward to take the position for striking he presses on a plate, breaks an electric circuit, and so releases a spring which pulls the trigger. He thus, after a few trials, is able to know the exact instant at which the ball will appear at the mouth of the gun, catches it with his eye at the moment of its emergence, and finds no difficulty in following its course. The problem of delivery is thus altogether eliminated, and a practice ball is sent which can be judged entirely by its course in the air. For general use a trigger must be devised which gives a short but definite interval between the pull on the catch and the explosion of the cartridge. With such a trigger the batter can accustom himself to the delivery of the gun when fired by another than himself as easily as to the delivery of a pitcher.

The fingers form the essential feature of the gun, and they, it may be observed, can be used with any form of projector. A catapult is in the process of construction in which a rigid arm moved by springs is suddenly arrested. The arm carries the ball in a holder, from which project two curved rods. At the moment of arrestation the rods are momentarily stationary, the ball then, rolling along them exactly as in the case of the gun, acquires a spinning motion.

But, on account of portability, ease of manipulation, and handiness, the gun appears to be the preferable form, and it remains to be seen whether it will supply the need which exists in baseball—the need of a generous supply of curved balls for practice.

The Passing of the Narrow Gage in America.

The passing of the narrow gage is again evidenced by the transformation of the track of an Iowa road from a gage of three feet to that of standard, which has just been accomplished without interrupting traffic an entire week day, says the International Ticket Agent. The road referred to, the Des Moines and Kansas City, having 112 miles of narrow gage track, was operated in connection with a standard gage road, the Keokuk and Western, 148 miles long, under the same ownership and management, making diversity of gage particularly undesirable. By widening 72 miles a continuous line 220 miles long is established between two important cities, and the immediate result will doubtless be increased traffic and reduced expenses from abolishing transfer of freight and passengers. Forty miles of the road are left unchanged for the present, but will inevitably join the majority ere long. Besides this, the only narrow gage track remaining in Iowa is that of the Burlington and Western and Burlington and Northwestern roads, aggregating 123 miles. These roads, which are conjointly operated, independently of the C., B. and Q. system to which they belong, are so situated that they are giving pretty satisfactory results, although their ultimate change to standard gage may be considered certain.

New Facts About Fishes.

Prof. A. E. Verrill, of Yale, has recently received new details concerning the great octopus which was found some time ago on the shore near St. Augustine, Fla. The professor classifies it as a species distinct from all known forms and proposes as a name for it Octopus giganteus. The part washed ashore was of at least six tons weight, which was about half its weight when living. The true length of the body is about 21 feet with a maximum width of about 7 feet and a diameter of at least 5 feet when living. Prof. Verrill thinks that two posterior stumps, looking like arms, may be the remains of lateral fins. Some of the arms were probably about 73 feet long. The dimensions of the Florida octopus are decidedly larger than those of any of the Newfoundland specimens which Prof. Verrill brought to public attention years ago. Prof. Verrill adds that the species is probably one of the kind upon which the sperm whale feeds regularly on our Southern coasts, and that the specimen found may have had suckers as large as a dinner plate, corresponding to the size of suckers once described to him by a trustworthy whaling captain.

In a number of the American Journal of Science, Prof. Verrill describes some singular nocturnal changes in the colors of fishes and their curious habits when sleeping at night. His observations were made between midnight and two o'clock A. M., the gas jets near his aquaria being turned as low as possible. Most fish, the professor says, sleep very lightly and are roused by almost imperceptible vibrations of air or water. Flounders thus seen sleeping at night showed their dark markings much more strongly than by day, and the same was true in greater or less degree of the markings of certain minnows, king fish, the black sea bass and trout, the latter becoming much darker by night than by day. This change is of a protective character. Describing other changes, Prof. Verrill says:

Other fishes, however, show much more remarkable changes. Among these the scup or porgy is one of the best examples. This fish, when active in the daytime, usually has a bright silvery color with iridescent tints. But at night, when asleep, it has a dull bronzy ground color and the body is crossed by about six transverse back bands. When one of these fishes with this coloration was awakened by suddenly turning up the gas, it immediately assumed the bright silvery colors belonging to its daytime dress. This experiment was repeated many times on different individuals with the same result. As this fish naturally rests among eel grass and seaweeds, the protective character of its nocturnal colors is obvious.

A common file fish was observed that presents a very decided change in color pattern. This species in the daytime is mottled with brown and dark olive green and the fins and tail are a little darker than the body, but when asleep at night its body becomes pallid gray or nearly white, while the fins and tail become decidedly black. These colors are decidedly protective at night or in a feeble light among rocks and weeds, where it lives. This and other species of file fishes when sleeping would usually rest on the bottom with the back leaning against the glass of the aquarium or against a stone at a considerable angle.

The common tautog or black fish has the curious habit of resting upon one side, half buried among gravel, or partly under stones, and is often curved in strange positions. It is easy to imagine that the flounders originated from some symmetrical ancestral form that acquired, like the tautog, the habit of resting upon one side, at first only when sleeping, but afterward continually, owing to the greater protection that this habit and its imitative coloration afforded. The one-sided coloration and the changes in the position of the eyes, etc., would gradually follow in accordance with well known laws of evolution.

The common squid was observed sleeping on several occasions. At such times it rests in an inclined position on the tip of its tail and on the basal parts of the arms, which are bunched together and extended forward, so that the head and anterior part of the body are raised from the bottom, so as to give room for breathing. The siphon tube is then turned to one side. Under these circumstances the color is darker and the spots more distinct than when it is active, owing to the expansion of the brown and purple chromatophores.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM TURBINE.—Louis Bollmann, Vienna, Austria-Hungary. This invention, also patented in the principal European countries, is for turbines worked by steam or gas, and provides for reducing the speed at which such motors have heretofore been rotated, and expanding the steam or gas usefully to a high degree. It comprises a bucket wheel with guides at the entrance and exhaust sides, and central plates adapted to receive steam at high pressure, while plates surrounding the first named plates have mixing chambers for receiving steam from the first named plates and openings for the admission of air. The central plates draw or throttle the high pressure steam and form it into a flat or conical jet to be mixed with a proportional large quantity of air or gas of low pressure, the invention contemplating a serial turbine having more than one circle of buckets and guides with their plates.

LOCOMOTIVE ENGINE. — Charles H. Booth, New York City. A large tender, having driving wheels and driving engines receiving steam from the main engine, is provided by this invention, the driving and fuel carrying capacity being such as to allow for long runs without stopping for fuel and water. On the forward truck are a high and a low pressure cylinder, the latter exhausting into the smoke stack, and connected to the rear of the main engine are a high and a low pressure cylinder on the truck of the tender, the exhaust here being into the water tank of the tender, which has drive wheels arranged under its overhanging sides.

Railway Appliances.

SWITCH OPERATING DEVICE.—Eduard von Haken, Charlottenburg, Germany. Pivoted centrally in the bed of the railway, according to this invention, is a three-armed lever, one of the arms being adapted to engage a switch point, and the other two arms, which extend rearwardly from the switch, having at their ends each a cam lying within the flange grooves of the rails. A vertically movable rod at each side of the car platform is held normally raised by a spring, but to move the switch point one of the rods is depressed to run through the flange groove of the rail and strike the cam. When one cam is within the rail groove the other will be outside its groove, and vice versa.

Bicycles, Etc.

PNEUMATIC TIRE.—John Carlyle Raymond, New York. A tire made of a series of interlocking rubber sections, according to this invention, is contained within a casing of canvas or other suitable material, the casing being slotted at the inside, and its sides fastened to a rim in which are door closed openings giving access to each section, and permitting of conveniently removing any one of the sections through its door. Set screws fasten the overlapping ends of adjacent doors, and should one section become punctured, it may be conveniently removed and a new one inserted without deflating the remaining sections or disturbing their positions on the wheel.

PNEUMATIC HANDLE.—Seward M. Gunsaul, Omaha, Neb. To take the place of the ordinary rigid, inelastic bicycle handle, this inventor has devised a handle with elastic body or casing secured to an iron stem with a bore at its outer end in which is fitted an air inlet and outlet valve. Provision is made for the admission and escape of air and easy regulation of the degree of distention and firmness of the body by the same valve attachment, which is perfectly protected in the bore of the stem, without unsightly projection. The elastic body of the handle may be of rubber or other preferred fabric.

BICYCLE ALARM.—John L. Leavitt, Albuquerque, and Emil Bibo, Bernalillo, New Mexico. According to this invention a gong is held by a clamp on the inside of one of the members of the front fork, the gong having a tubular hub in which slides a plunger, the forcing of which outward brings the outer end of a tongue of novel form in contact with projections or lips on the spokes of the wheel, causing the gong to sound, while, if the tongue be forced still farther out, the hammer is free from the gong and the alarm makes only a buzzing, whistling or rattling sound. The alarm may be intermittent or continuous, as desired. The plunger and tongue are forced outward by a lever having a link connection with a lever fulcrumed on the handle bar.

BICYCLE GEAR.—Joseph Wheatley, Memphis, Tenn. According to this improvement, a sprocket wheel on the rear brace bar, under the seat, is rotated by a chain whose ends are connected to pedal levers whose rear ends swing on the axle of the rear wheel, the levers being connected near their forward ends by a strap extending around a roller on a depending hanger. The sprocket wheel is a bevel gear meshing with two bevel gears loosely mounted on a shaft at right angles, rotating in bearings on the rear fork, and rigidly mounted on this shaft, at the outer side of each bevel gear, is a ratchet wheel engaged by dogs. There is also rigidly mounted on the shaft a sprocket wheel from which a sprocket chain extends to the sprocket wheel on the rear wheel axle. This gear is designed to facilitate attaining a high speed and give a notable increase of power.

Mining, Etc.

SAFETY GRIP FOR MINING CAGES.—William H. Beakey, Walkerville, Montana. An appliance by which a cage may be easily and safely stopped at any time or place, in case of accident, is provided by this invention. In the shaft are vertical guides and locking mechanism to engage them, the mechanism being connected with a lever arm normally engaged by a pivoted crab, there being a lever and connecting rod to operate the arm and a catch to support the lever. By depressing a hand lever, a crab is raised to release the lever arm, which rotates gears to throw toothed cams into locking engagement with the fixed vertical guides on the sides of the shaft.

Mechanical.

WRENCH.—Henry A. Smith, Elgin, Ill. This is an adjustable "alligator" wrench, of light weight, strong and inexpensive to manufacture, and capable of use in any way in which a monkey wrench may be applied, but particularly adapted for holding round objects. The adjustable jaw is closed by a nut and screw, entirely disconnected from the jaw, and opened by a spring when released from the tension of the screw, the latter serving in a great measure as a brace for the movable jaw, enabling the wrench to be used on very heavy objects within the range of its adjustment. The wrench is flat, taking up but little space, and is designed to be especially convenient and handy for a wide variety of uses.

BAR AND SHAFTING TURNING MACHINE.—Jacob Fitz, Hanover, Pa. In this machine the head may be arranged to turn or used stationary and put on the ordinary lathe carriage. The tubular stem has a face plate on which tools are held to be movable in and out, a tool block for each tool and the blocks being engaged by an adjusting band, a beveled surface being provided whereby the band may force the blocks inward and so adjust the tools correspondingly. Carriers on opposite sides of the stem are provided with means for clamping the shaft, and the carriers may be engaged with or feed from the feed screw.

ROOF FRAMING TOOL. — John Parkhill, Rochester, Minn. This invention relates to a formerly patented roof-framing tool of the same inventor, and provides a tool principally designed for automatically indicating and marking the proper side bevel of a jack rafter of any pitch. It has a member with a straight marking edge in the plane of a bearing, and a finger pivoted thereto about an axis arranged transversely of the marking edge, to swing in line with the marking edge and at an angle to the plane of the bearing.

Agricultural.

CULTIVATOR.—Talbot Andrews, Monmouth, Ill. This invention is for an improvement in wheeled straddle row cultivators for corn and cotton, the cultivating devices being adapted to act on two rows of corn at once, and being shiftable laterally by levers without necessitating any change in the direction of the team. The draught attachment has a three-horse evener by which the draught of the middle horse equals or balances the other two. There are two double sets of cultivating devices, each set being composed of two gangs of rotary disks, a vertical arch which rigidly connects them, and two pivoted draught bars attached to the gangs and arch. The bars may be adjusted different distances apart, thus contracting or widening the arches, according as it is desired to have greater or less space between the two sets of disks.

MILK AERATOR. — John Littlejohn, Aurora, Ill. To eliminate from fresh milk the animal gases, odors and heat, rendering the milk more pure and palatable and enabling it to be kept a longer time without becoming rancid or sour, this inventor has devised a novel straining and spraying device to accomplish the aeration in one operation as the milk is transferred to the cans in which it is to be shipped or stored. The milk is passed through a strainer into a receiver, a bottom flange of which has upwardly opening holes to spray the milk up against the walls of a surrounding vessel, from which it falls in drops or a thin sheet, to be again divided by perforations in the bottom of a pan below. From a still lower pan the milk is conducted through a cooler to the storage or shipping cans. The parts are all detachably connected, to facilitate packing and shipping.

CAPTURING AND DESTROYING INSECTS.—Joseph Strouhal, Beeville, Texas. Two patents have been granted this inventor for means for destroying insects destructive to plants and vegetables, more particularly the cotton boll weevil, machines being devised to run over a row of cotton plants and dislodge the insects, causing them to fall into pans where they will be killed by poison, the cotton removed at the same time being received upon screens and held out of contact with the poison. A wheel-supported frame on which is a driver's seat carries another movable frame, supporting pendent pans and screens, between which, as the machine is driven over the field, the plants project upward. According to one of the patents, the plants are simply struck by arms to dislodge the insects, while, according to the other patent, they are brushed by revolving brushes, the latter being adjusted higher or lower according to the growth of the plants, but in both cases the insects are dislodged and fall through the screens which support the cotton into the poison receptacles. The most effective poison for destroying the weevil and its eggs and larvæ is composed of turpentine, crude kerosene oil and carbolic acid.

Miscellaneous.

COPYING CAMERA STAND. — Owen Linley, London, England. To facilitate the production of negatives to be used in making "process" engravings, this inventor has devised a camera in which gearing connects the camera front with the sliding copying board, to shift the latter in its own plane in correlation with the focusing motion, so as to maintain constant during the focusing the predetermined position of the picture on the focusing screen, and enable the camera to be adjusted for dimension and focusing while continuously viewing the picture on the screen. Links connect the slide rest with a hand lever at the back of the camera, and a micrometer screw stop limits the rearward movement of the screen carrier. There is also a mechanism for adjusting the ruled screen within the camera in front of the plate.

AUTOMATIC FLUID GOVERNOR. — George W. Browne, Brooklyn, N. Y. A governor more especially designed for use on gas supply pipes has been devised by this inventor. It comprises a casing with longitudinal bore, at one end of which is a bell-shaped mouth engaged by a valve, while a chamber at the other end is connected with a supply, the chamber having a movable and perforated bottom for increasing or diminishing its capacity. The ball valve in the bell-shaped mouth of the bore regulates the amount of gas delivered automatically to the desired quantity, irrespective of the pressure in the gas mains.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

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(7167) C. F. H. K. says: Will you please let me know what kind of acid will change the color of blue print photography paper to a dark brown? Also how much to use of it and how long to use it, and if you use it before, or after washing the prints.

A. Borax ..... 2½ oz.
Hot water ..... 38 "

When cool add sulphuric acid in small quantities until blue litmus paper turns slightly red, then add a few drops of ammonia until the alkaline reaction appears and red litmus paper turns blue. Then add to the solution 154 grains of red crude gum catechu. Allow it to dissolve, with occasional stirring. The solution will keep indefinitely. After the print has been washed out in the usual way, immerse it in the above bath a minute or so longer than it appears when the desired tone is reached. An olive brown or a blackish brown is the result.

NEW BOOKS, ETC.

ELECTRIC POWER TRANSMISSION. A Practical Treatise for Practical Men. By Louis Bell. New York: The W. J. Johnston Company. 1897. Pp. 491. Price $2.50.

The familiar power house of the Niagara Falls generating plant gives the subject for the frontispiece of this exhaustive book. It really seems as if an adequate treatment was at last given to an all-important subject. The design of the author has been to avoid the following up of the abstract mathematics of the subject, simply introducing such conditions as are quite essential to a proper treatment of the subject. He devotes his energies on the other hand to putting into tangible shape the most recent results in this branch of electrical science. At the same time he seems to have avoided giving the work the unsatisfactory aspect of a purely theoretical one, and on turning over its pages it seems evident that an excellent contribution to a subject hitherto inadequately treated is here to be found. It does seem as if the index for so comprehensive a book might have been considerably greater in extent.

SEWER FLUSHING DIAGRAMS. Showing how far the Discharge from a Flush Tank will give a Self-Cleansing Velocity. S. H. Adams. New York: Spon & Chamberlain, 12 Cortlandt Street. London: E. & F. N. Spon, 125 Strand. Price $5.

These diagrams are devoted to data relating to the action of pipe sewers established by actual tests, and, despite its somewhat high price, it is to be treated as a sine qua non in advanced engineering practice, and hence receives our commendation.

REISSMANN'S RAFTER AND POLYGON GAGE. Copyright 1897. Price 30 cents.

This diagram is somewhat in the same line as the one just spoken of, and is designed for the use of carpenters. It gives rules for laying out complicated roofs, measuring the timbers and framing complicated roofs in general.

The Bridgeport Wood Finishing Company have recently issued, more especially for the use of architects, a specimen book containing samples of different woods finished with the Wheeler wood filler and the Breinig stains, which is something quite remarkable in the way of catalogue work. The book contains forty-eight specimens of oak, mahogany, cherry, cypress, maple, whitewood, sycamore, curly birch, pine, ash, etc., mounted on heavy cardboard, their finely finished surfaces protected by layers of soft cotton, and all showing the great beauty which can be developed in clearly bringing out the natural grain of a wood and finishing it with a high polish, which the materials furnished by this company render entirely practicable. The samples given are but a small percentage of the kinds of wood on which these finishes are applied, but the book forms a volume almost as large as a dictionary.

The 1897 catalogue of the Keuffel & Esser Company, of New York, has considerable new matter, and its entire text and illustrations are well worth the attention of artists, draughtsmen, surveyors, architects and engineers. The book has 424 pages, and we are informed that 400 of its engravings are separately copyrighted, as well as the text. The company has long held a leading position as manufacturers and importers of drawing materials and surveying instruments, and has a most enviable reputation for furnishing the widest variety and the very highest qualities of everything which any one may desire to purchase in their line. The reading matter of the book also affords a most excellent guide to a sound judgment when one is selecting either instruments or materials.

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JUNE 15, 1897,

AND EACH BEARING THAT DATE.

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Case. See Show case.
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Cleaner. See Cistern cleaner.
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(Continued on page 412)

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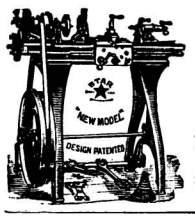

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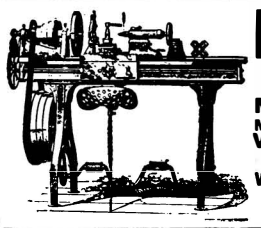

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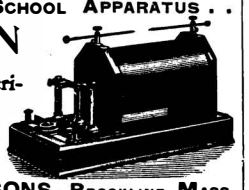

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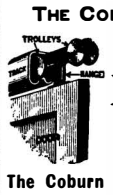

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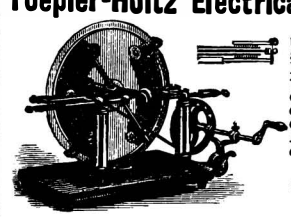

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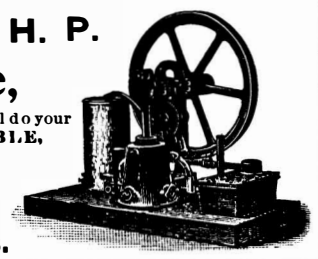

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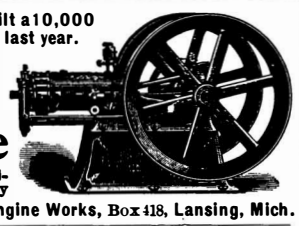

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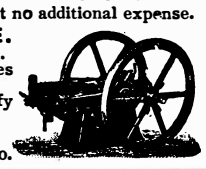

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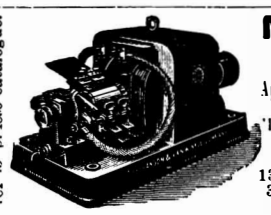

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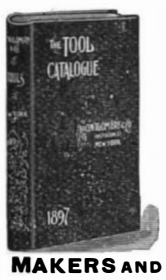

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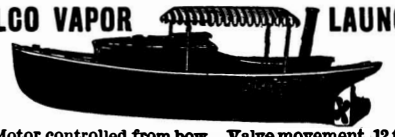

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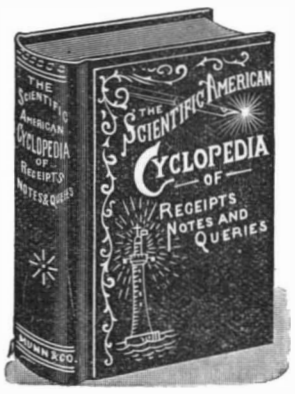

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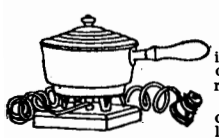

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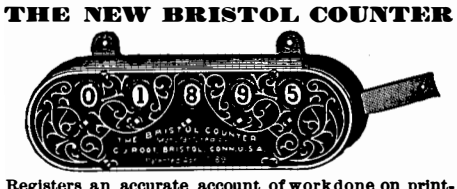

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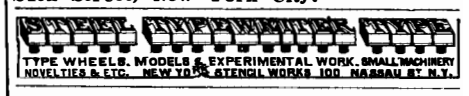

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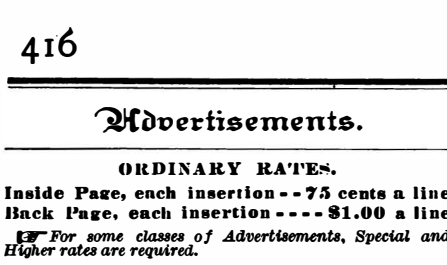

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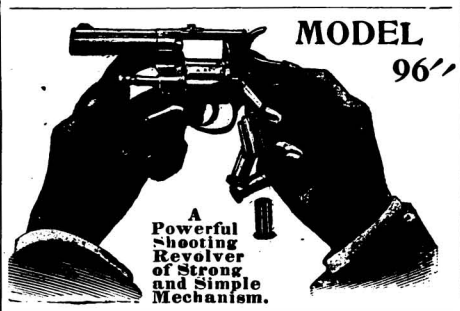

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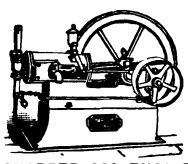

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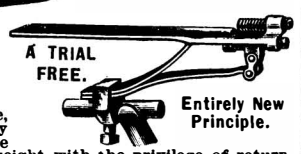

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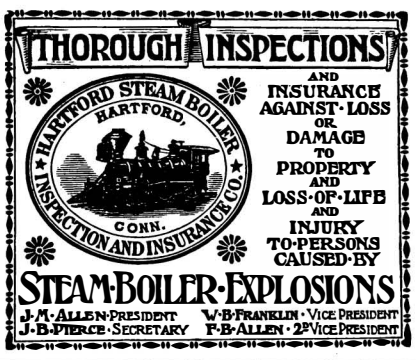
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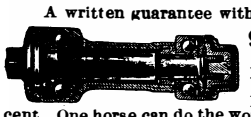

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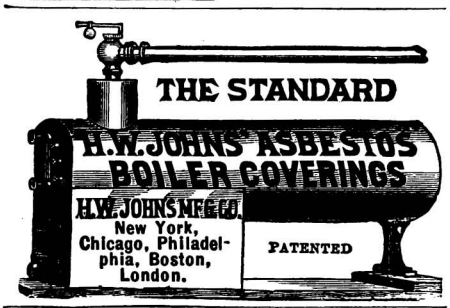

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